MECHANICAL ENGINEERING

January 1957

in this issue

1956—Then What? . . . . . J. W. Barker 4

Arnold Engineering Development Center . . . . J. M. Wild 8

Metallurgical Yield-Stress Observation . . . J. W. Jacobson 13

The Role of the Mechanical Engineer—
in Rubber, Petroleum, and Chemical Industries
. . . . . D. B. Schau, M. B. Berry and W. E. Chandler 16

ASC and Affiliate Member Societies . . . . . E. P. Lange 20

Utilization of Lignite . . . . . E. C. Miller and C. F. Hawley 23

Recent Technical and Economic Developments
in Western Europe . . . . . F. S. Blackall, Jr. 27

The ASME Council Reports Activities
in 1955–1956 60

ASME Honors Engineers 68

1956 ASME Annual Meeting 75

Availability List for 1956 ASME Annual Meeting Papers . . 98

DEPARTMENTS

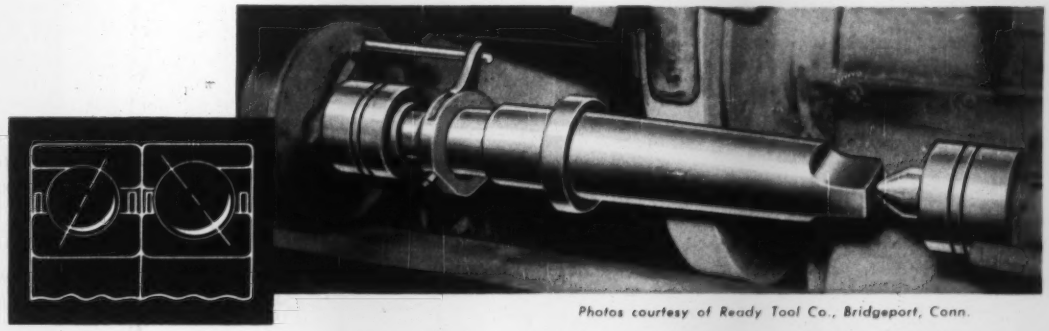
Editorial 3
Reviews of Books 90
Applying the Record 51
Readings 101
Equipment Survey 66
ASME News 114
ASME Technical Digest 46
Keep Informed . . . . . Adv. p. 41

Philadelphia, Pa. • March 10-14, 1957

FACTS

about

NEW DEPARTURE **BALL BEARINGS**



Photos courtesy of Ready Tool Co., Bridgeport, Conn.

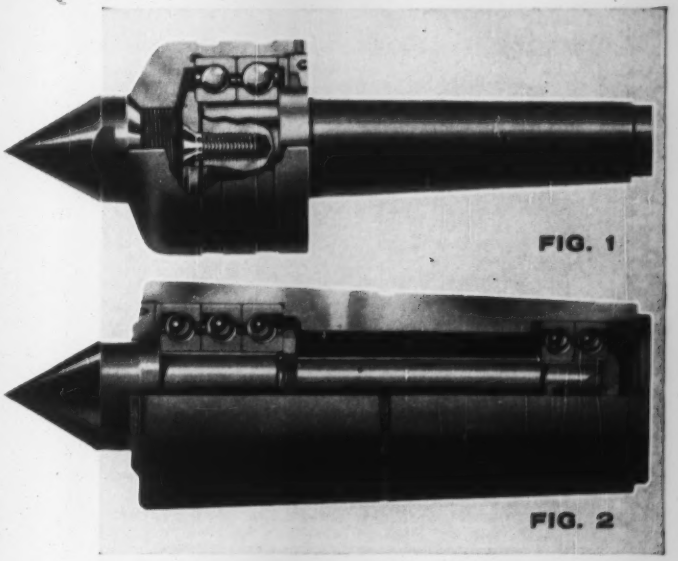
PRELOADED BALL BEARINGS HELP CENTER MAKERS GUARANTEE ACCURACY TO WITHIN .000050"!

Accuracy . . . *to within less than .000050" total indicator run-out!* That's the performance live centers designed around New Department preloaded ball bearings deliver!

Such super accuracy of work stems from *extreme rigidity* . . . the unsurpassed ability of these preloaded duplex ball bearings to handle combination loads with minimum deflection.

In live center applications, New Departure ball bearings with medium and high contact angles are mounted duplex and positively clamped together to assure the correct predetermined preload condition. As work expansion increases the thrust load, radial centering becomes more rigid and accuracy is precisely maintained.

New Departure ball bearings for live center applications are made to ultra-precision tolerances. Smooth operation with low frictional loss is assured, as well as continuity of accuracy throughout long life. Write for further details.



(Fig. 1) Tapered-shank, spindle-type center in which New Departure ABEC 7 specification duplex ball bearings support grinding loads with undiminished accuracy throughout long use.

(Fig. 2) Enclosed spindle designed around five New Departure ultra-precision preloaded duplex ball bearings.

SEE "WIDE WIDE WORLD" SUNDAYS—NBC-TV

BALL BEARINGS MAKE GOOD PRODUCTS BETTER

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

MECHANICAL ENGINEERING, January, 1957, Vol. 79, No. 1. Published monthly by The American Society of Mechanical Engineers, at 20th and Northampton Sts., Easton, Pa. Editorial and Advertising departments, 29 West 39th St., New York 18, N. Y. Price to members $3.50 annually, single copy 50¢, to nonmembers $7.00 annually, single copy 75¢. Add $1.50 postage to all countries outside the United States, Canada, and the Pan-American Union. Entered as second-class matter December 21, 1920, at the Post Office at Easton, Pa., under the Act of March 3, 1879. Member of the Audit Bureau of Circulations.

GREENLEE BROS. & CO. CUT FUEL COSTS 17%

B&W boilers with Jet Ignition Stokers assure savings despite increased fuel prices

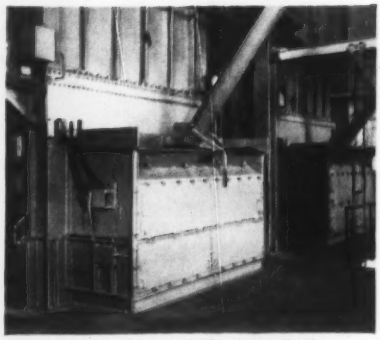
As one of the country's leading machine tool manufacturers, Greenlee Bros. & Co., Rockford, Illinois uses large amounts of steam for all year operation of air compressors and for plant heating. And to maintain profitable overall operation it is important that the steam supply be dependable—and steam generating costs kept to the minimum.

Since the installation of two B&W Integral-Furnace Boilers, Greenlee has enjoyed uninterrupted steam service from a dependable, efficient source. Equipped with modern B&W Jet Ignition Stokers, these units have built a record of operating efficiency while burning a wide variety of Illinois bituminous coal.

At Greenlee, as at other industrial plants using steam, careful consideration of long term costs and proven reliability were important factors in the choice of B&W Integral-Furnace Boiler units.

If your steam production cost is important . . . if you are considering steam plant modernization or expansion for increased dependability and efficiency . . . it will pay you to investigate B&W's more than 90 years of boiler experience. Let us show you what it can do for you.

For further information or assistance write to The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.



Two B&W Integral-Furnace Boilers at Greenlee, equipped with B&W Jet Ignition Stokers, burn a wide variety of Illinois bituminous coal.

HERE'S WHY YOUR STEAM COSTS LESS With B&W Integral-Furnace Units

- Minimum floor space and headroom requirements
- High fuel economy
- Smokeless combustion
- Adaptable to all fuels and firing methods
- Economical fast steaming
- Water-cooled furnace
- Clean, dry steam at all ratings, even with high boiled water concentration
- Quick response to wide and heavy load swing demands
- Easy to inspect and clean
- High availability with least attention

BABCOCK & WILCOX

BOILER DIVISION

G-827-1B

Eleven lines of WALWORTH Saddle Type Wedge Gate Valves

Bronze-Mounted — All-Iron — Ni-Resist
Outside Screw and Yoke — Non-Rising Stem — Quick Opening
Flanged Ends — Screwed Ends

Walworth saddle-type wedge gate valves are manufactured in eleven different combinations of designs and materials, seven of which are illustrated above.

Saddle type wedge gate valves are easy to take apart and are particularly suitable for lines requiring frequent cleaning. Walworth Saddle-Type Wedge Gate Valves are available in a variety of designs including OS & Y; Inside Screw Rising Stem, and Sliding Stem Quick Opening types—in Bronze-Mounted, All-Iron, and Ni-Resist. All types are designed to permit repacking under pressure in either the open or closed position.

FOR COMPLETE INFORMATION, See your local Walworth Distributor or write on business stationery for illustrated circular.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WALWORTH

60 East 42nd Street, New York 17, New York

SUBSIDIARIES: ALOYCO ALLOY STEEL PRODUCTS CO. CONOFLOW CORPORATION GROVE VALVE & REGULATOR CO. SW SOUTHWEST FABRICATING & WELDING CO., INC. MH M & H VALVE & FITTINGS CO. WALWORTH COMPANY OF CANADA, LTD.

GEAR
Specialties, Inc.
2635 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS
OF FRACTIONAL HORSEPOWER GEARING

IF YOU NEED VIBRATIONLESS GEARS
IT'S A JOB FOR
G. S. PATENTED GROOVES

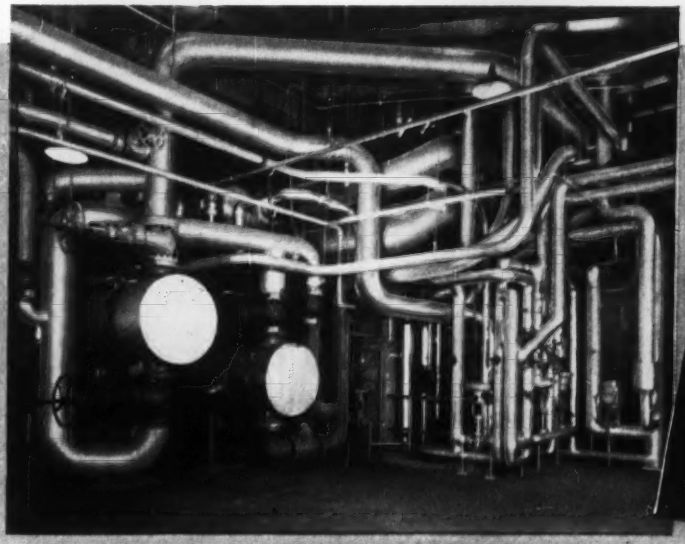
G. S. research has now *overcome vibration and flutter* in Small Gearing for many vital applications. G. S. PATENTED GROOVES, as pictured here, successfully insulate vibrations of worm and gear teeth from reaching the shaft. Ultra smooth, *noiseless* operation is more than ever assured by the use of Bakelite Gears. ★ Whatever YOUR Gearing problem, you can depend upon G. S. research and engineering to lend powerful aid in reaching a successful solution. Here, you can, *without cost or obligation,* draw upon experience gained through 40 YEARS of specialization in the design and mass production of better Small Gearing exclusively. Send drawings and particulars today. Get the ONE best and most economical application for the job!

SEND FOR FREE *6-page Small Gearing Guide. It describes 80 types and applications. Contains useful charts . . a valuable aid to anyone interested in Small Gearing. Use company letterhead, please. No obligation, of course. Write today!*

FRACTIONAL HORSEPOWER GEARING

40 Years of Specializing in Small Gearing!

. largest power plant piping job ever done by one contractor . . .



Heaters and auxiliary steam station.
Of the approximately 11,740 pieces of shop-fabricated piping supplied by Midwest in record time, less than ¼ of 1% (24 pieces) required correction for all causes.

. . . and that contractor was MIDWEST PIPING CO.

With a capacity of 1,075,000 kilowatts, Kyger Creek Plant of the Ohio Valley Electric Corporation† is the largest power plant piping contract (combining fabrication and erection) ever performed by a single contractor. Midwest Piping Company was selected for this critical project because of its long experience in serving the public utilities and because of its outstanding shop facilities and field organization. That this confidence was not misplaced is evidenced by the fact the piping was finished ahead of the original fast schedule.

Unit No. 1 was placed in service during January, 1955 while the fifth unit went on stream less than a year later . . . in December, 1955.

Some idea of the size of this project can be gained from the fact that Midwest supplied approximately 11,740 subassemblies of shop-fabricated piping and at one time had more than 650 men on the erection. To meet the required delivery schedule, fabrication was done at both the St. Louis and Clifton Plants.

Whether for a small job or a giant . . . Midwest can furnish you better piping faster. You will find it to your advantage to call in Midwest whenever you need piping.

OVEC†
THE SPONSOR COMPANIES

Appalachian Electric Power Company*
The Cincinnati Gas & Electric Company
Columbus and Southern Ohio Electric Company
The Dayton Power and Light Company
Indiana & Michigan Electric Company*
Kentucky Utilities Company
Louisville Gas and Electric Company
Monongahela Power Company**
Ohio Edison Company
Ohio Power Company*
Pennsylvania Power Company***
The Potomac Edison Company**
Southern Indiana Gas and Electric Company
The Toledo Edison Company
West Penn Power Company**

SUBSIDIARY OF *American Gas and Electric Company **The West Penn Electric Company ***Ohio Edison Company

Engineering by American Gas and Electric Service Corp. and Sargent & Lundy

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.
PLANTS: ST. LOUIS, CLIFTON, N. J. and LOS ANGELES

SALES OFFICES:

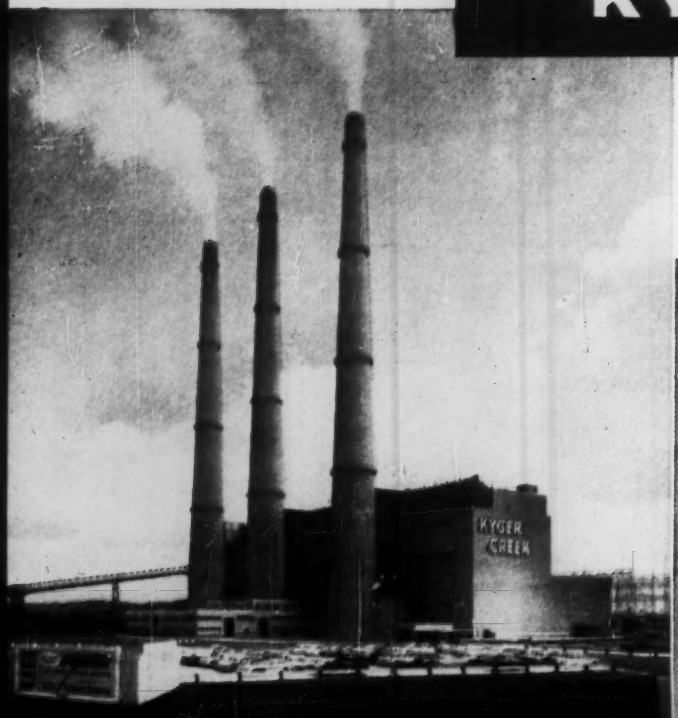
ASHEVILLE (BOX 446, SKYLAND, N.C.)
BOSTON 27—486 FIRST ST.
CHICAGO 3—79 WEST MONROE ST.
CLEVELAND 14—616 ST. CLAIR AVE.
HOUSTON 2—1213 CAPITOL AVE.
LOS ANGELES 33—520 ANDERSON ST.
MIAMI 34—2103 LE JEUNE
NEW YORK 7—50 CHURCH ST.
ONEIDA, N.Y.—282 NORTH MAIN ST.
SAN FRANCISCO 11—420 MARKET ST.

MIDWEST PIPING SERVICE IS NATIONWIDE

7576

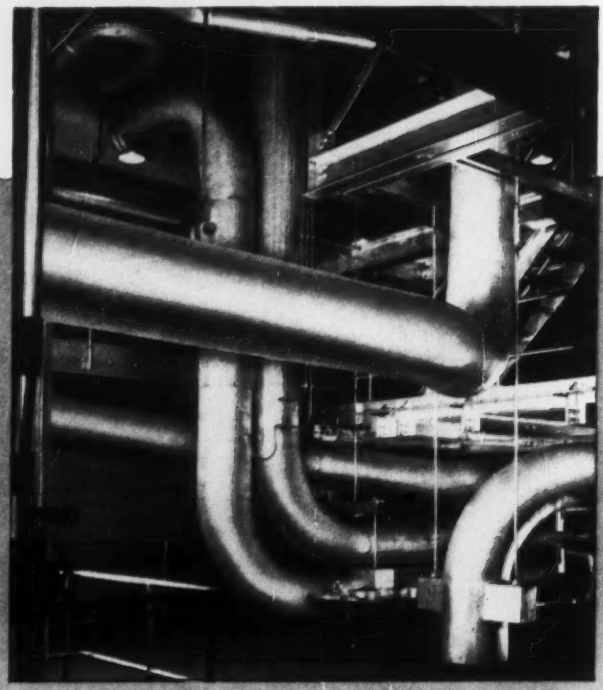
CONTRACTORS FOR MORE THAN 50 YEARS

KYGER CREEK . . .

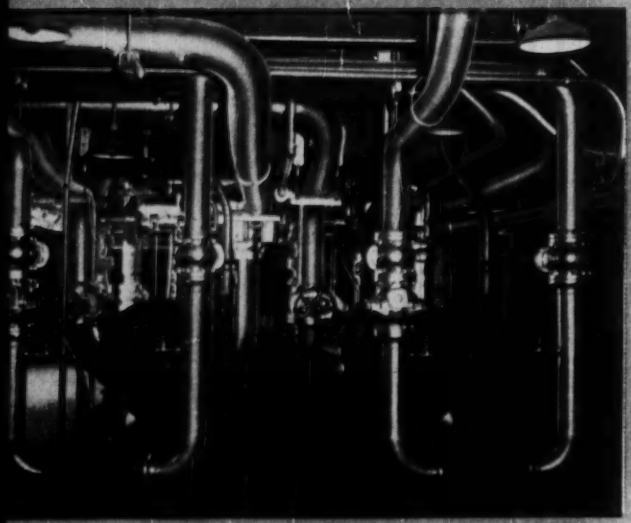


COMPLETED APPROXIMATELY THREE MONTHS AHEAD OF THE ORIGINAL FAST SCHEDULE

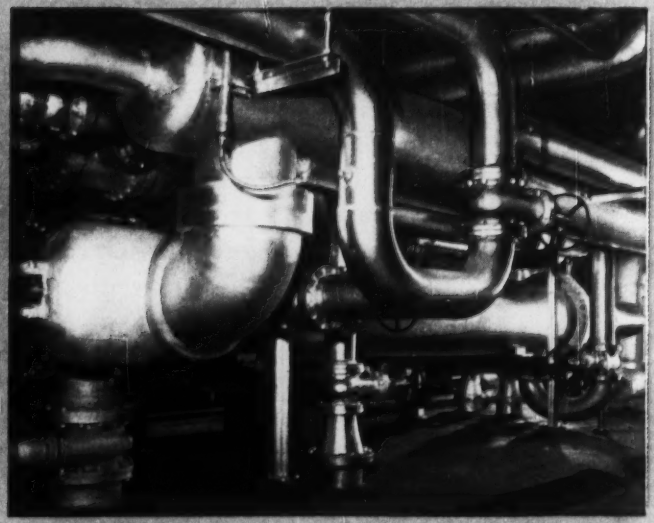
Operating Conditions: 2070 psi and 1050° F.



Main steam piping is 13" OD, 2¼" wall thickness, 2¼% Cr—1% Mo.
More than 1,300 high pressure welds were made in the field; inspection by Gamma Ray disclosed that only three of these welds needed minor repair.



Condensate piping.
The piping for Kyger Creek required approximately 3,500 valves larger than 2", 16,000 valves 2" and smaller, and 6,000 instrument valves.



Condensate and bearing cooling water coolers.
Kyger Creek piping used approximately 62,000 carbon steel machine bolts, 5,800 alloy studs, 7,000 carbon steel backing rings and 2,000 alloy backing rings.

MIDWEST . . . PIPING FABRICATORS AND

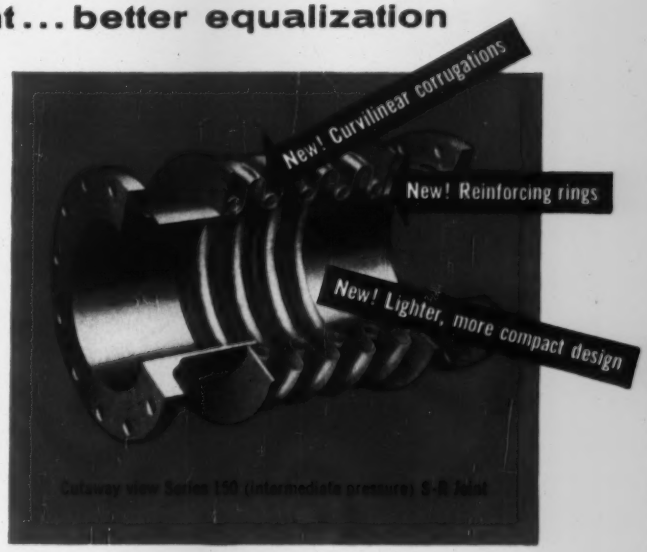
most experienced manufacturer

Revolutionary new design provides longer cyclic life... less weight... better equalization

Over three years of intensive research and testing have paid off! Badger S-R Expansion Joints — corrugated packless expansion joints of an entirely new design — are ready for your most exacting power, heating, industrial and process piping applications.

Two significant features of the new joints are 1.) Curvilinear Corrugations, which result in natural "all-curve" flexing and equal distribution of movement among the corrugations; 2.) tubular Reinforcing Rings, which work with the new corrugations to produce greater effective flexing height and "all-curve" flexing even under higher pressures and temperatures.

And there are other important features, too . . . size for size, Badger S-R Joints weigh up to 50% less than conventional types . . . new ring design reduces joint diameter . . . a complete line of accessories — including covers and liners — are available . . . standard models in stainless, monel and inconel, special types in any workable alloy.



New corrugation and ring designs produce better equalization, "all-curve" flexing

Series 50 (low pressure) S-R Expansion Joints

The radically different Curvilinear Corrugations used in Badger S-R Expansion Joints were developed by the Badger Research Department. As shown in the cross-section of a Series 50 Joint (left), the design produces more uniform movement per corrugation and flexing to a natural "all-curve" shape, which results in lower stresses and therefore increased life. (White line in diagram shows the efficient "all-curve" shape the corrugations *naturally* assume under operating pressures.)

Series 150 (intermediate pressure) S-R Expansion Joints

Series 150 S-R Joints feature Curvilinear Corrugations and, because they are used at higher pressures, also have tubular Reinforcing Rings. A significant engineering improvement, these new rings make metal-to-metal contact only in the "valley" of each corrugation yet allow natural "all-curve" flexing (white line) when the pipeline is subjected to pressure. The tubular shape of the rings also permits greater effective flexing height and therefore contributes to longer joint life.

Learn more about ways S-R Joints can be of advantage to you . . .

New illustrated brochure describes them in detail — mail coupon for your free copy today.

© 1956 BMC

Badger Manufacturing Company
230 Bent Street
Cambridge, Massachusetts

Name _____

Company _____

Street and No. _____

City _____ Zone _____ State _____

NEW DESIGN from the world's

BADGER

S·R*

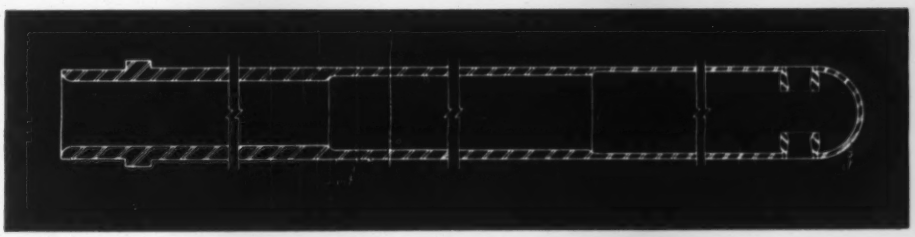
EXPANSION JOINTS

* *Service-Rated*

LONG RETRACTING BLOWER

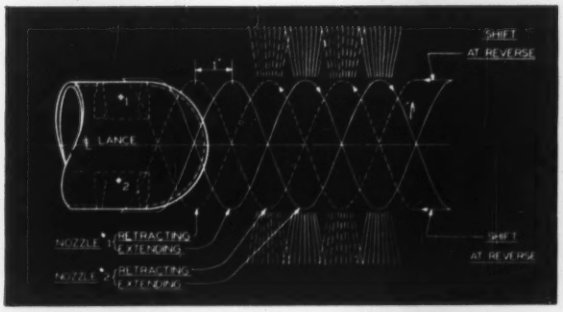
The Diamond Series 300 IK Blower sets a new and higher standard of efficiency, economy and dependability in the cleaning of heating surfaces that require a long retracting lance type blower. Pointed out in detail are some of its important features. Others are a *single* outboard support point to simplify installation and the attractive "backbone" cover for greater rigidity and protection of the entire blower assembly from dirt, damage, the elements and personnel hazards.

This new Series 300 IK is the culmination of more than 20 years' experience building and applying long travel blowers. It well illustrates the Diamond design philosophy: *"Keep it simple . . . keep it basic . . . avoid unnecessary complications."* It is further evidence of the fact that YOU CLEAN BOILERS BETTER AND AT LOWER COST WITH DIAMOND BLOWERS.



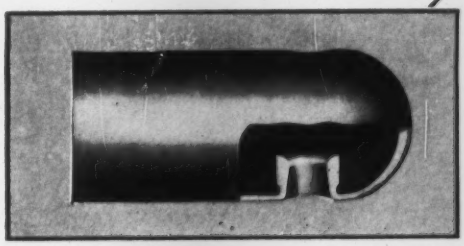
STEP-TAPER LANCE
(FOR EXTRA LONG TRAVEL)

Extra long lance has minimum droop due to step-taper construction which employs up to four different wall thicknesses. Lightest wall is at nozzle end to reduce bending moment. Lance is chrome alloy for heat resistance.



IMPROVE CLEANING PATTERN

Close and positively controlled helical cleaning pattern assures maximum cleaning effectiveness. Blowing pattern diagram illustrates how return travel path is exactly intermediate with forward travel path so that there is a *positive nozzle sweep every inch.*

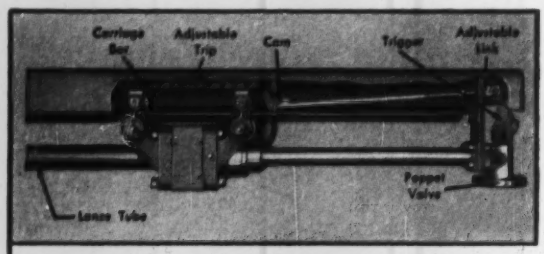


IMPROVED DIAMOND NOZZLE

New design Diamond "Type A" Nozzle is the result of several years' research and the testing of more than 50 different contours. The modified venturi produces maximum impact pressure and cleaning effectiveness with minimum expenditure of cleaning medium. (Steam or compressed air.)

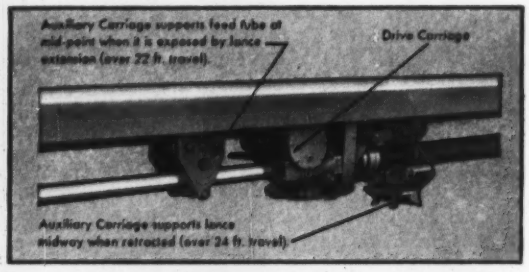
SPECIALTY CORP. **LANCASTER, OHIO**
DIAMOND SPECIALTY, LIMITED—Windsor, Ontario

Introducing DIAMOND SERIES 300 IK



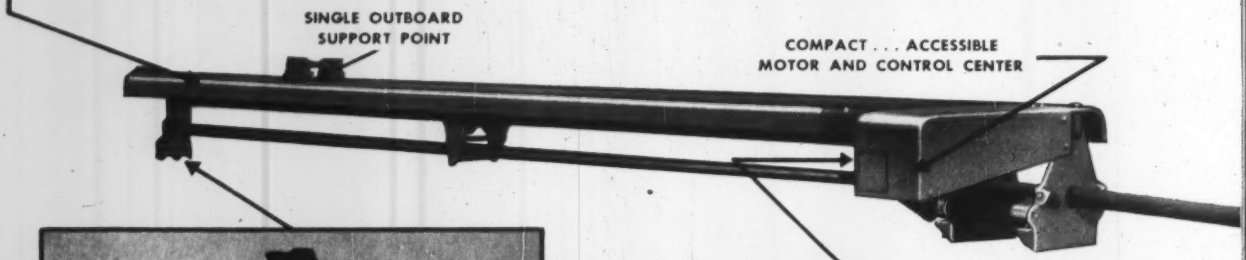
MECHANICALLY OPERATED VALVE

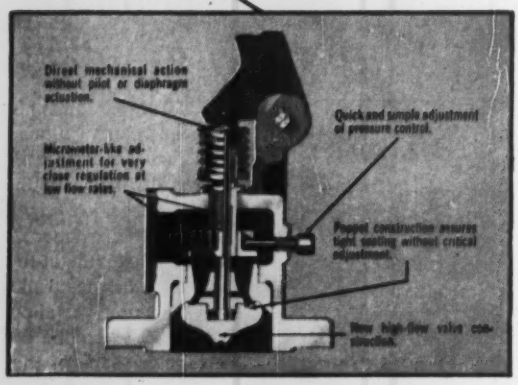
Control of blowing medium is automatic, positive and accurate by means of a simple, dependable mechanically operated valve. As lance begins movement into boiler, trip on carriage opens valve through a linkage. At end of retraction, trip closes valve. All pilot or diaphragm valve elements are eliminated. Trip is adjustable.


Auxiliary Carriage supports feed tube at mid-point when it is exposed by lance extension (over 22 ft. travel).
Drive Carriage
Auxiliary Carriage supports lance midway when retracted (over 24 ft. travel)

AUXILIARY CARRIAGES (FOR EXTRA LONG TRAVEL)

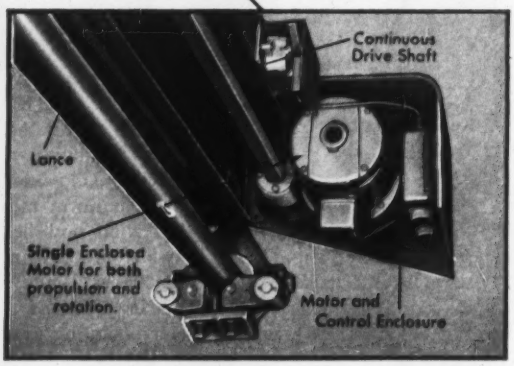
On extra long blowers, one auxiliary carriage supports lance midway when retracted, preventing undue bending. Second auxiliary carriage is dropped at mid-point to support feed tube when it is exposed by lance extension.




Direct mechanical action without pilot or diaphragm actuation.
Quick and simple adjustment of pressure control.
Micrometer-like adjustment for very close regulation at low flow rates.
Poppet construction assures tight seating without critical adjustment.
Slow high-flow valve construction.

POPPET VALVE WITH ADJUSTABLE PRESSURE CONTROL

Diamond dependable poppet valve with improved streamlined flow contours and adjustable pressure control that permits easy, accurate setting of pressure at individual valve and independent of other blowers. Poppet construction assures tight seating without critical adjustment. Stem, seat and disc are stainless steel. Stellited seating surfaces are available.



STATIONARY GEAR MOTOR

Lance propulsion and rotation are by a *single* enclosed gear motor which drives a continuous shaft running the full length of blower and providing power to carriage. This construction makes it possible to mount motor in a fixed position at the front end for better protection and accessibility.

7394

DIAMOND POWER

ADAMSON

in bulk material conveying equipment

The movement of bulk materials is a critical phase of the production process. It can be a costly one unless the most modern, scientific methods and equipment are used.

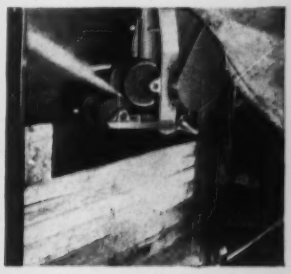
For over fifty years, to the whole wide range of industry, the big name of STEPHENS-ADAMSON has signified the finest engineering know-how in bulk materials handling equipment. Over these years, S-A engineers have been called upon by power producers, chemical processors, wood and paper product manufacturers, food processors, the mining industry the rock products industry, and many other classifications of industry, for solutions to their peculiar problems.

This year, increased demand for your product plus competitive pressure may dictate a long, close look at your bulk material handling methods. This is where an S-A sales engineer can offer solid advice. His background assures you of the very best system for your investment.

Remember the big name of S-A. It's your BEST BUY when experience counts most.

Twin S-A conveyor belts and tripper installation carries refractory clay to storage bins. Belt conveyors are adaptable to a wide variety of bulk products, can deliver big tonnage with low cost and little maintenance.

A double wing stacker built by S-A delivers a high volume of material to either side. It travels on track, can stack to a height of 80 feet. Tripper in housing feeds to either conveyor boom.



Swiveloader trims a boxcar, throwing grain to furthest corners. The S-A line of loaders range from portable pilers and car loaders to huge ship trimmers. They handle a wide variety of products.

Bulletins are available on all S-A conveyor equipment. Write today.

SINCE 1901 S-A STEPHENS ADAMSON MFG. CO

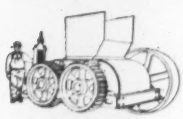
STEPHENS-ADAMSON MFG. CO.

19 RIDGEWAY AVENUE, AURORA, ILLINOIS
LOS ANGELES, CALIFORNIA
BELLEVILLE, ONTARIO

S-A manufactures a wide range of material handling products in three complete plants in U. S. and Canada.

- Belt Conveyors
- Belt, Pan and Plate Feeders
- Ship Loading Boom Conveyors
- Stacking Conveyors
- Storage and Reclaiming Systems
- "Natural Frequency" Vibrating Conveyors
- REDLER Conveyor-Elevators
- ZIPPER Conveyor-Elevators
- Conveyor Belt Cleaners
- Headshaft Holdbacks
- Grizzlies and Screens
- Centrifugal Pilers
- Bin Gates and Tunnel Gates
- Car Pullers and Spotters
- Bucket Elevators
- Skip Hoists
- SEALMASTER Ball Bearing Units

DESIGNED TO HANDLE ANY DRY BULK MATERIAL



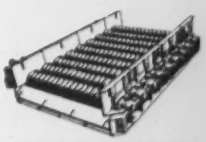
ROLL AND RING CRUSHERS

BUCKET ELEVATORS & CONVEYORS

VIBRATING CONVEYORS

ZIPPER CONVEYOR-ELEVATORS

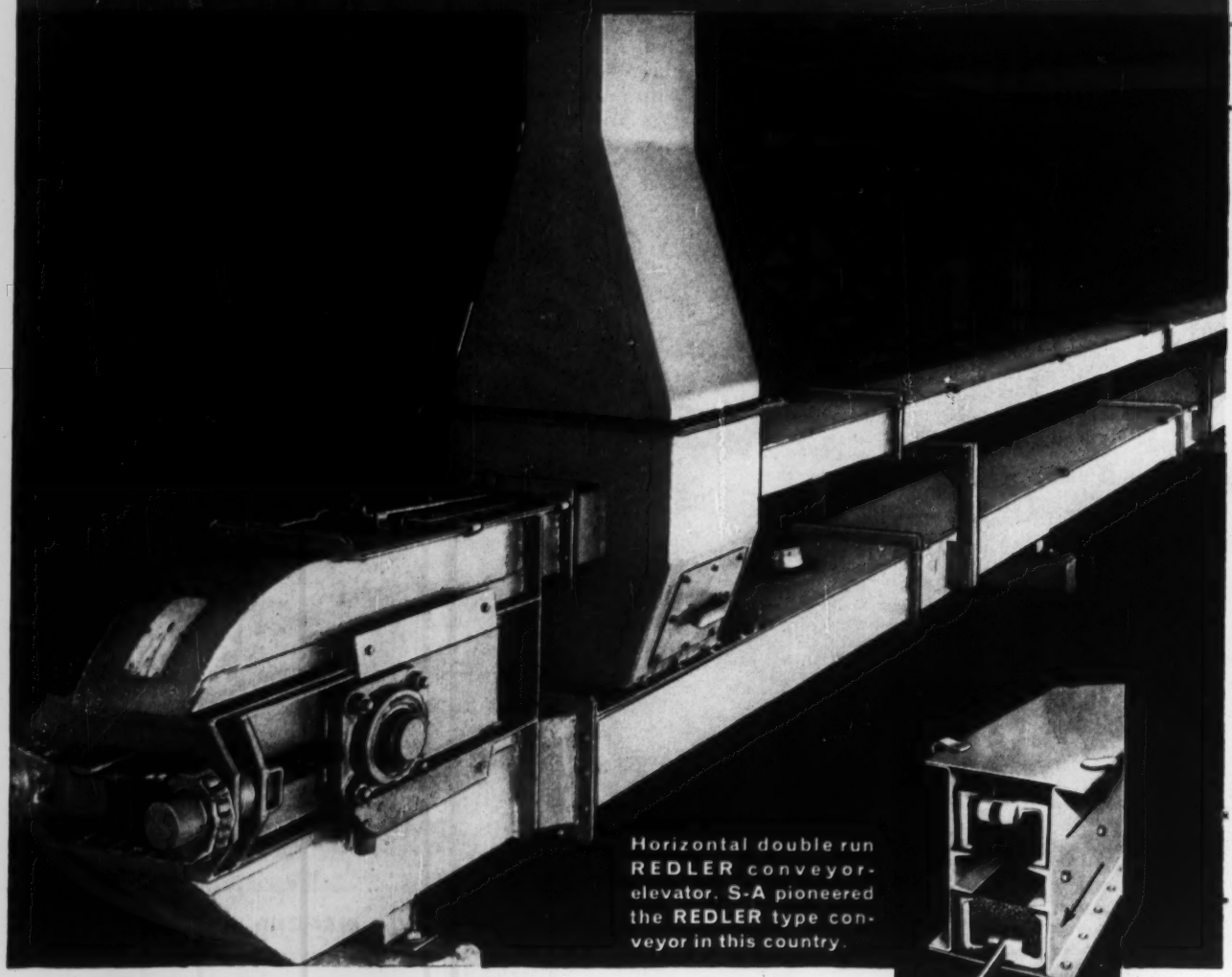
REDLER CONVEYORS, ELEVATORS



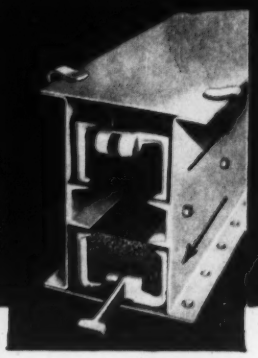
LIVE ROLL GRIZZLIES

STEPHENS-

your Best Buy

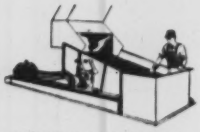


Horizontal double run REDLER conveyor-elevator. S-A pioneered the REDLER type conveyor in this country.



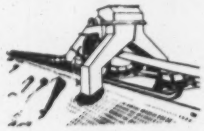
S-A MANUFACTURES A COMPLETE LINE OF PRODUCTS

BELT CONVEYORS

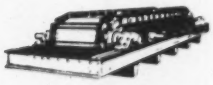


VIBRATING SCREENS

MANGANESE STEEL PAN FEEDERS

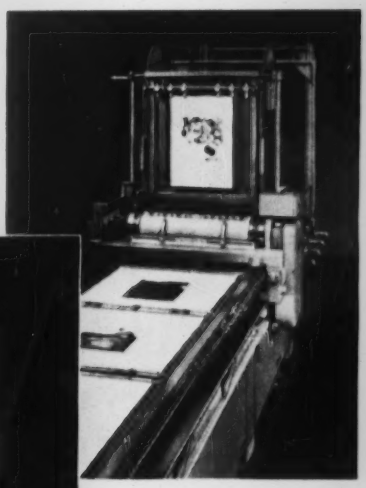


BELT CONVEYOR TRIPPERS

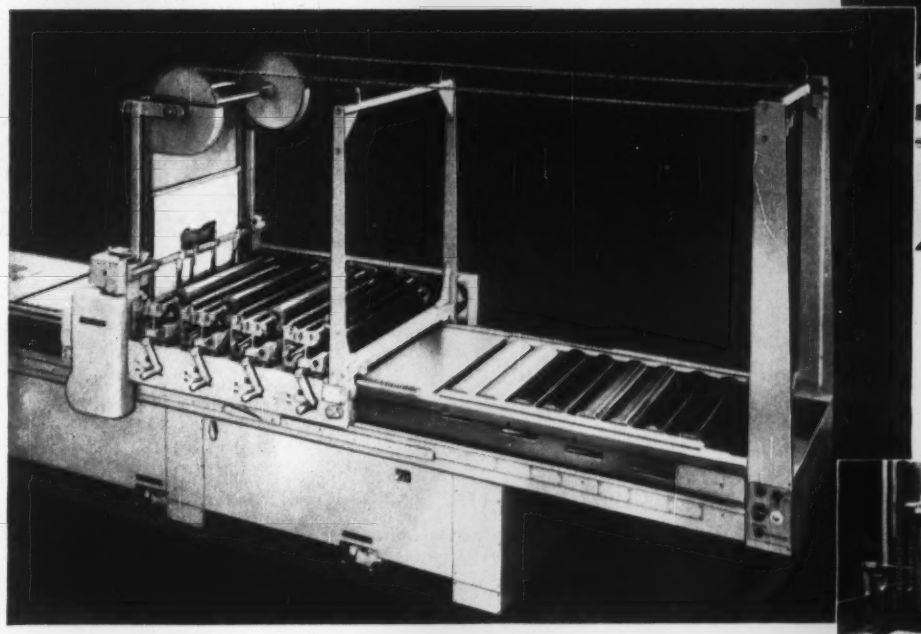


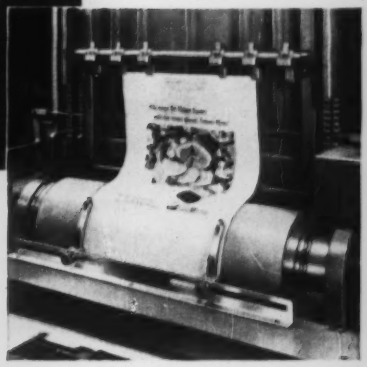
PAN CONVEYORS

SPEED and PRECISION



◆Vandercook 604 High Speed Four-Color Test Press equipped with Automatic Sheet Delivery. Diamond Roller Chains assure positive, *precision* operation.





◆At the end of the printing stroke, grippers remove the finished proof and automatically return it to the operator's station.

WITH DIAMOND ROLLER CHAINS

◆High efficiency Diamond Roller Chain drives give the machinery designer and builder greater flexibility in the placement of driving and driven components. Diamond Roller Chain is used for motor drives, to position materials, time operations, convey products, automate and coordinate machinery functions. It transmits great horsepower in relation to its weight. Center distances can be long or short, speeds high or low, and because Diamond Roller Chain is symmetrical in design, sprockets may be operated in either direction depending on whether they are positioned for inside or outside engagement.

More than 66 years of experience in mechanical power transfer is available to you at Diamond—without obligation. Call on the Diamond Engineering staff now.

DIAMOND CHAIN COMPANY, Inc.

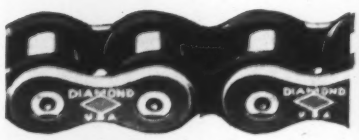
Where High Quality is Traditional

Dept. 413, 402 Kentucky Ave., Indianapolis 7, Indiana

Offices and Distributors in All Principal Cities

Please refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER

Write today for Catalog 754 —packed with helpful installation data.



DIAMOND ROLLER CHAINS

Inside Story on POWELL PRESSURE SEAL VALVES

Pressure seal valves may appear similar on the outside. However, the Powell Pressure Seal Valves are quite different in design and in manufacture. And the inside story on Powell Pressure Seal Valves is that every valve has PERFORMANCE VERIFIED.

Only the finest materials are used in Powell Pressure Seal Valves, and painstaking quality control is rigidly enforced through each step of manufacture. For example, every machining operation is accurately gauged. All parts are thoroughly cleaned and degreased and thoroughly inspected.

Because of Powell's painstaking quality control, plant shutdown through valve failure is practically unknown. Records from power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE quality line which has PERFORMANCE VERIFIED.

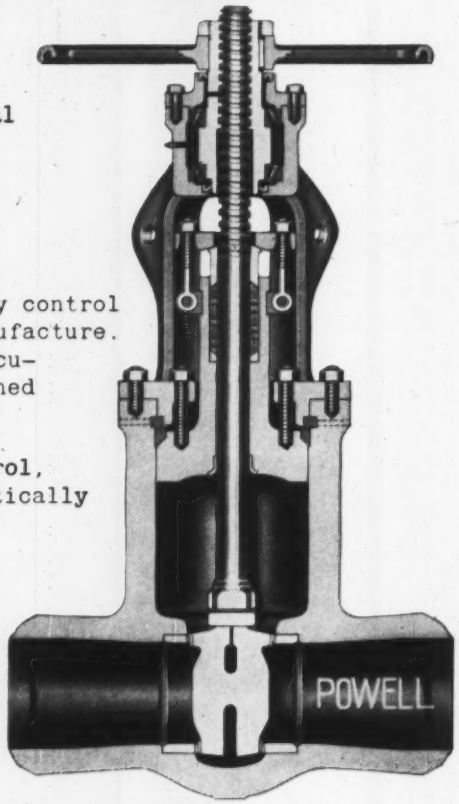


FIG. 11303 -- (Sectional) 1500-Pound Pressure Seal Steel Gate Valve

Fig. 1314-A -- 1500 Pound Integral Bonnet Steel "Y" Valve.

FIG. 11365 -- 1500-Pound Pressure Seal Piston Guided Horizontal Lift Check Valve

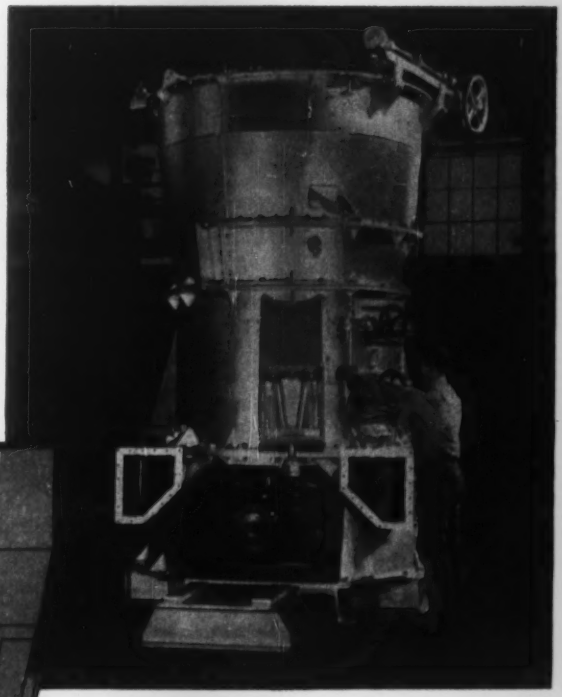
PERFORMANCE PV VERIFIED

The Wm. Powell Company, Cincinnati 22, Ohio . . . 111th YEAR

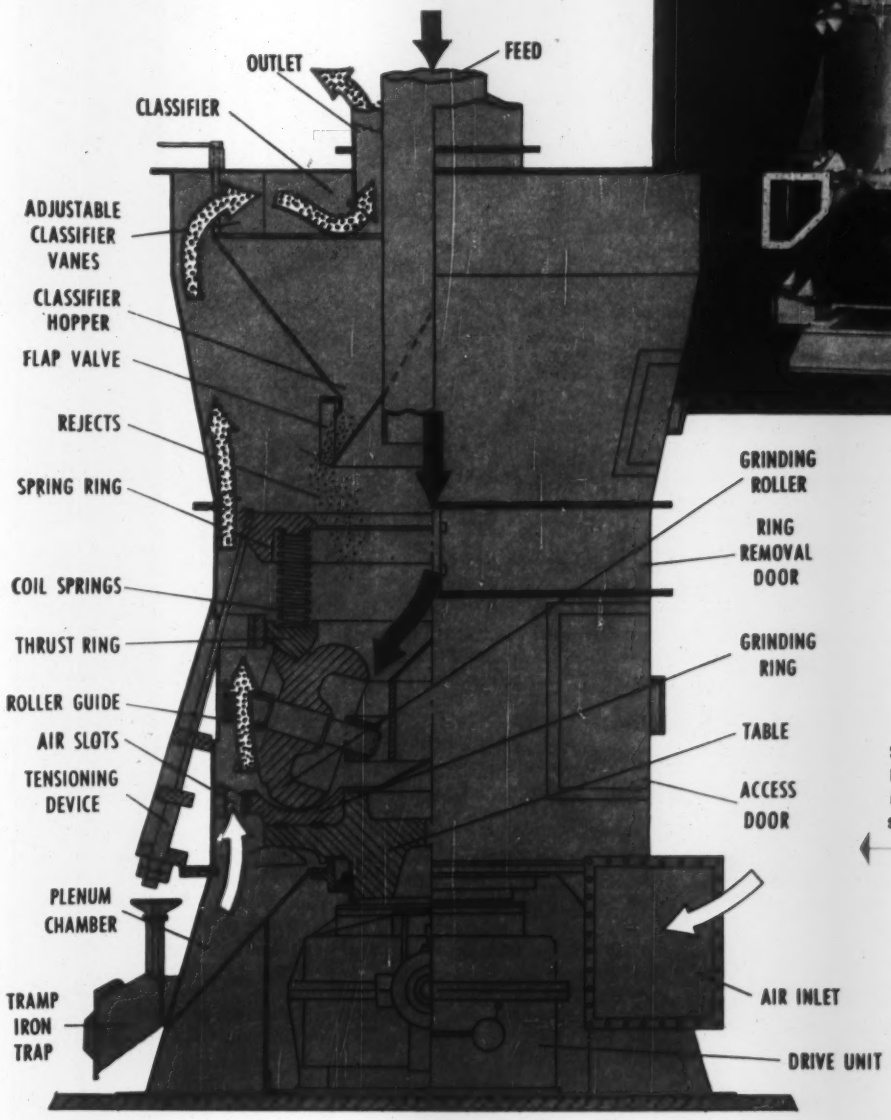
POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES

Table Pulverizer



Exterior view of completely assembled Foster Wheeler Type MB planetary roll and table pulverizer.



Sectional drawing of Type MB pulverizer with parts identified to show construction and operation.

Planetary Roll and

complements the Foster Wheeler line of pulverized fuel systems

THE FOSTER WHEELER Type MB planetary roll and table pulverizer, developed in Germany, is a constant-speed mill which has proved to be exceptionally efficient and economical to operate and maintain.

In the MB pulverizer, grinding action takes place between a slowly rotating horizontal table and three spheroidal rollers, uniformly spaced around the axis of the table and subjected to controlled thrust pressure by a large number of coil springs. The motion of the table causes the rollers to rotate while circling planet-fashion and rolling over the material on the grinding ring.

Air or gas, entering from below the pulverizer table, floats the ground particles up into the classifier, located in the top of the housing. Particles too coarse to float fall back onto the table for further pulverization. All routine adjustments to the spring tension gear or classifier vanes can be made externally while the mill is in operation.

Wide experience abroad indicates that this new addition to the complete line of heavy-duty FW pulverizers offers the following advantages.

1. *Low Power Consumption*
   Assures exceptional economy of operation, year after year.

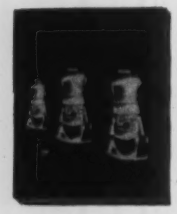
2. *Low Maintenance*
   Extremely rugged construction and accessibility of wearing parts reduces down-time for servicing.

3. *Uniform Product Fineness*
   Pulverizer and classifier design assures extreme uniformity of particle size.

4. *Pressurized or Suction Operation*
   Provides complete flexibility for various types of service.

5. *All Necessary Adjustments Made Externally with Mill Operating*
   Avoids shut-downs for changes in pulverizer pressure or classifier adjustment.

6. *Simple Renewal and Replacement of Grinding Rolls and Table*
   Cuts down-time for infrequent replacement of wearing parts.

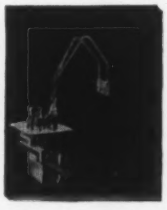


THE TYPE MB PULVERIZER, with Foster Wheeler feeders, distributors, burners and fans or exhausters, provides an exceptionally efficient and economical pulverized fuel system.

For complete information on the new PLANETARY ROLL & TABLE PULVERIZER, write for Bulletin MB-55-5.

For full details on Foster Wheeler heavy-duty BALL MILL pulverized fuel systems, write for Bulletin BP-53-3.

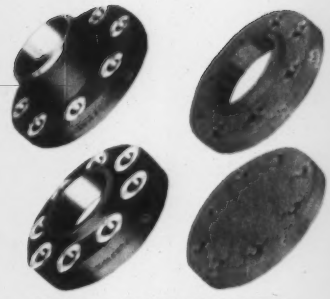
Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.



FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

BUTT WELDING FITTINGS
(IPS)



ASA and MSS FLANGES

LADISH

FOR

Complete Service

IN

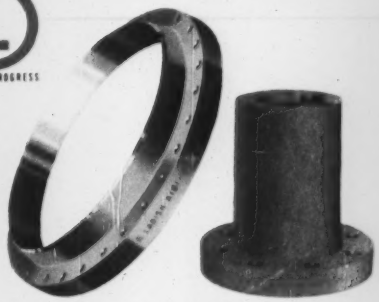
Controlled Quality

FITTINGS

CARBON • ALLOY
AND STAINLESS STEELS

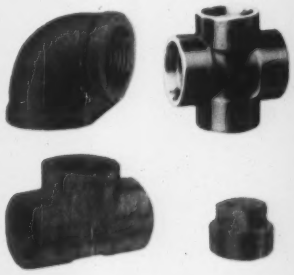
TO MARK PROGRESS

BUTT WELDING FITTINGS
(TUBE O.D.)



LARGE O.D., TEMA and
LONG WELDING NECK FLANGES

UNIONS



SCREWED and SOCKET FITTINGS

WHATEVER your fittings requirements . . . regardless of the type, size, wall thickness, pressure rating or material specification . . . you can get prompt, efficient, *complete service* by specifying LADISH and ordering from your local Authorized Ladish Distributor.

A broad, full-range line produced to unsurpassed standards of metallurgical and manufacturing integrity . . . plus adequate local stocks . . . gives you double assurance of satisfaction.

For complete service on your fittings requirements . . . call your Authorized Ladish Distributor.

Catalogs available on request. Please indicate specific product lines for which information is desired.

THE COMPLETE *Controlled Quality* FITTINGS LINE

LADISH CO.

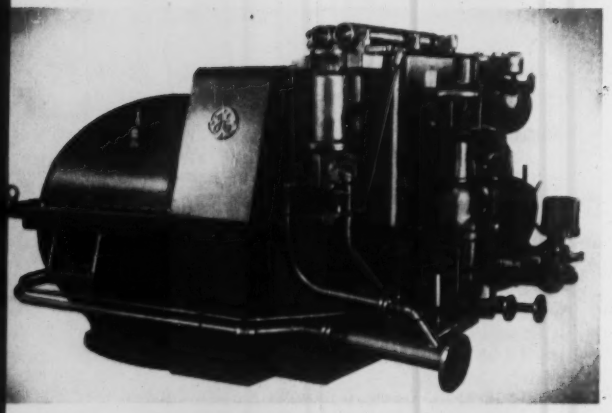
CUDAHY, WISCONSIN
MILWAUKEE SUBURB

Distant Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland
Chicago • St. Paul • St. Louis • Atlanta • Houston • Odessa • Tulsa • Denver
Los Angeles • San Francisco • Seattle • Havana • Mexico City • Brantford, Ont.

HIGH-SPEED COMPRESSORS

VIBRATION RECORD, inset, is obtained by exciting buckets. Peaks indicate resonant vibration response of buckets. For more reliable operation, G-E engineers confine bucket exciting frequencies to "quiet zones" between the peaks.

How General Electric Engineers Locate "Quiet Zones" for Safer High-speed Turbine Operation



TYPE DRV HIGH-SPEED MECHANICAL-DRIVE TURBINE

* In Canada, contact Canadian General Electric 107 Park St., Peterborough, Ontario

When driving modern compressors and blowers, G-E high-speed turbines spin at operating speeds of 7000 rpm and up. At such speeds, if resonant vibration were not controlled carefully, bucket fatigue failure might result.

HERE'S HOW General Electric combats the problem: Natural vibration frequencies of the buckets on each new turbine rotor are determined with the special equipment shown above—an oscillator, crystal pick-up, and high-speed level recorder. "Quiet zones" of minimum normal vibration are clearly revealed.

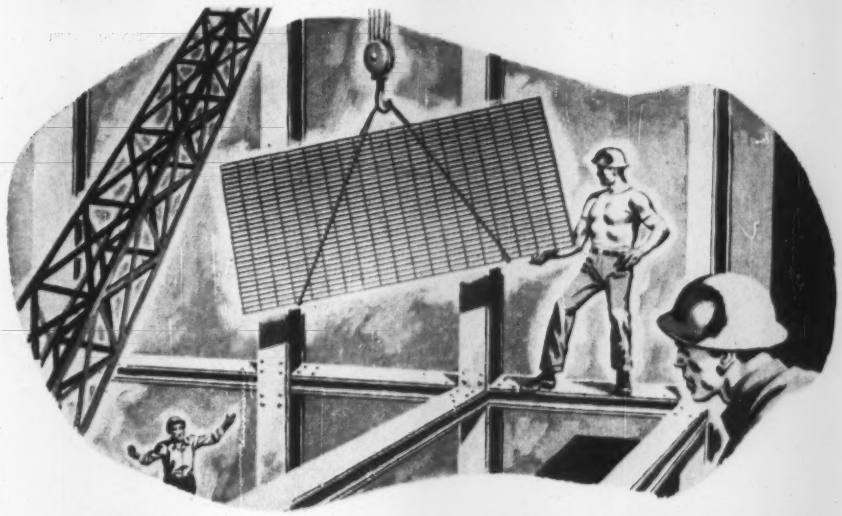
With this information available, the number of nozzles can be varied so that steam striking the buckets will create vibration-exciting frequencies only in these "quiet zones." By thus making sure that steam-impact frequencies don't coincide with critical natural frequencies, the chance of bucket failure is greatly reduced.

VIBRATION TESTING is one of many features adding to G-E high-speed turbine reliability. For more information, contact your G-E Apparatus Sales Office* or write for bulletin GEA-6232, Section 241-2, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

BUILDING?



? INDUSTRIAL PLANTS
? POWER HOUSES
? PUBLIC UTILITIES
? PUBLIC BUILDINGS
? COMMERCIAL BUILDINGS
? PETRO-CHEMICAL UNITS
? BRIDGES
? HIGHWAYS
? SHIPS
? HOUSING

WHATEVER YOU ARE BUILDING

. . . there may be a grating application that can save you time and money and improve the project. As founders of the grating industry, with over half a century of experience, the Irving Grating Company is well qualified to recommend designs to help you solve specific problems.

We are manufacturers of Riveted, Pressure-locked and Welded Gratings in Steel, Aluminum and other metals.

TYPICAL USES OF IRVING GRATING:

Open Steel Flooring
Safety Treads
Floor Armoring
Walkways
Trench Covers
Balconies
Loading Platforms
Vestibule Mats
Sun Deflectors
Bridge Decking
Draingrates
Contour Retainer Grid for Refractory Shells

SOME OF THE ADVANTAGES:

Self-Cleaning
Self-Draining
Permits passage of light and air
Lightweight
Strong
Will last indefinitely
Fireproof
Resists Corrosion
Simple to Install
Minimum maintenance
Custom built

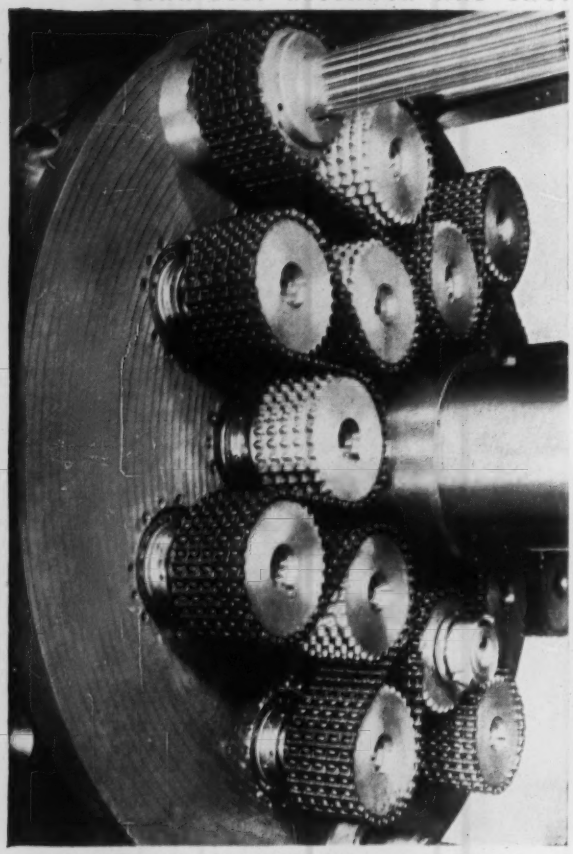
"A FITTING GRATING FOR EVERY PURPOSE"

IRVICO®
ESTABLISHED 1902

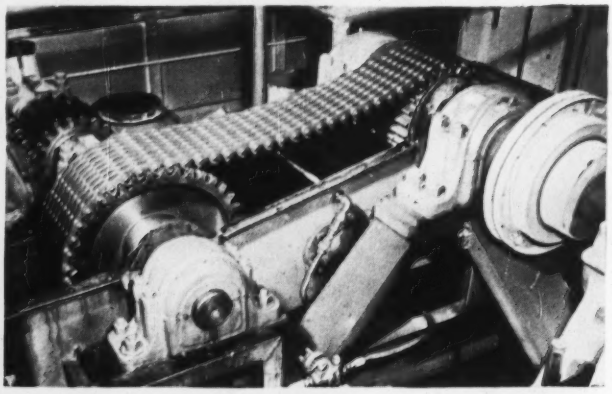
IRVING SUBWAY GRATING CO., Inc.
ORIGINATORS OF THE GRATING INDUSTRY

Offices and Plants at:
5010 27th St., LONG ISLAND CITY 1, N. Y.
1810 10th St., OAKLAND 20, CALIFORNIA

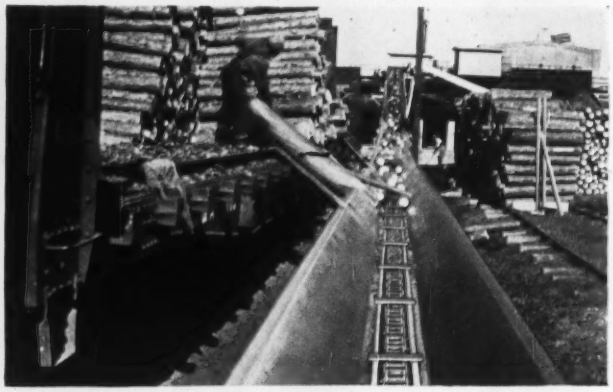
Representatives in Canada, Mexico and South Africa



PRECISION STEEL ROLLER CHAIN, on serpentine machine tool drive, incorporates such Link-Belt long-life "extras" as shot-peened rollers and lock-type bushings.



SILENT CHAIN DRIVE comfortably handles extreme peak loads of draw bench service. This better-than-98%-efficient chain is available in sizes from $\frac{3}{16}$-inch pitch to 2-inch pitch.



CLASS C COMBINATION CHAIN — with pusher attachment every 12th link—forms a dependable conveying medium for pulpwood logs at this modern paper mill.

Because Link-Belt makes industry's most complete chain line, the best one can be recommended for your job . . . assuring

extra life in drives and conveyors

Since every drive and conveying application has its own particular combination of wear, speed and load conditions, correct chain selection is all-important to maximum life. And there's no better way for industry to meet its specific needs than by selection from Link-Belt's broad line of power transmission and conveying chains — silent and roller chain; cast, combination, forged and fabricated chain.

For applications destructive to certain metals, Link-Belt offers the alternatives of steel, malleable iron and longer-wearing Promal. There's still further specialization offered by a wide range of attachments that adapt these chains to variations of specific service. And where needs are unique, Link-Belt can call on unmatched experience to guide development of new designs.

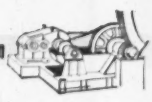
Whether you manufacture equipment incorporating chain or need only a single replacement strand, let Link-Belt aid your selection. Call your nearest Link-Belt office or authorized stock-carrying distributor. Or write LINK-BELT COMPANY, DEPT. AV, Prudential Plaza, Chicago 1, Ill. 14,269

LINK-BELT

One source . . . one responsibility

for materials handling

power transmission



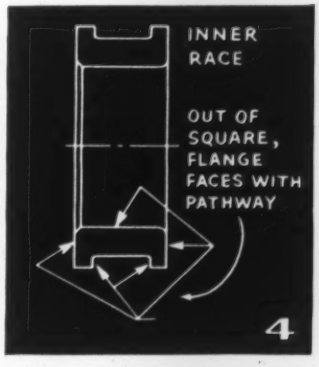
processing machinery

Checking wall variation, flange run-out and race end squareness on combination gauge.

3. SQUARENESS OF ROLLER ENDS AND FLANGE FACES

One other tolerance that contributes to the running efficiency of HYATT Hy-Load Series Bearings of the flanged race type is the *squareness of roller ends with roller diameters* and the *squareness of flange faces with the race pathways.*

Flanged race bearings are commonly used for locating shafts laterally and for running conditions of light and intermittent thrust load. For best operating results, the ends of the rollers must be flat and square with the diameter within a matter of tenths. The lateral clearance between the roller and the race shoulders must also be held to a minimum. This means close tolerances on roller length and race pathway width, and the flange face, Figure 4, must be square with the roller pathway. When all these conditions are satisfied, there will be no tendency for the rollers to skew and raise the operating temperature of the bearing, nor will there be any unusual force on the separator or cage with a tendency toward wracking and noisy operation.



The *side run-out* of the individual races or the *out-of-square* of the ends with the fitting diameters is also important, especially in applications where a number of parts are held together endwise and where the pressure might be sufficient to tilt the race, creating a condition of excessive taper on the roller pathway with consequent roller skewing and the development of excessive heat and noise.

All these internal dimensions and clearances are so carefully controlled that HYATT Hy-Roll Bearings have built an unsurpassed reputation among design engineers for exceptionally long, smooth and trouble-free performance.

YOU WILL FIND MORE DETAILS

in HYATT General Catalog No. 150, or your nearby HYATT Sales Engineer will gladly help you choose the type best suited to your design requirements. Remember, HYATT is America's first and foremost maker of cylindrical roller bearings. Hyatt Bearings Division of General Motors Corporation, Harrison, New Jersey.

GM GENERAL MOTORS

HYATT HY-ROLL BEARINGS FOR MODERN INDUSTRY

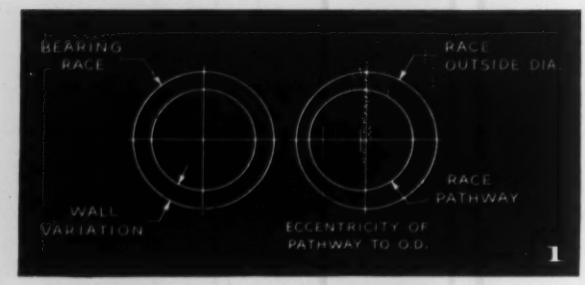
The Inside Secrets of Smoother Performance

How HYATT quality controls assure race concentricity, roller diameter uniformity and other internal essentials of smoother, longer-lived cylindrical roller bearings . . .

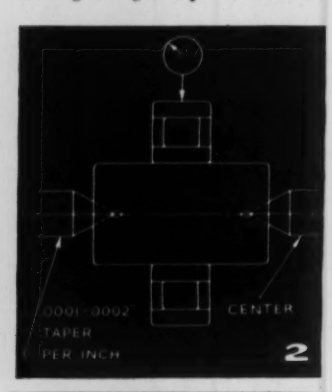
The running accuracy and smoothness of a roller bearing is governed primarily by its internal dimensions and clearances. The most important of these are:

1. CONCENTRICITY OF RACE DIAMETERS

Eccentricity of race diameters is usually interpreted in terms of *wall variation*, Figure 1, on the individual components and in terms of *radial run-out* on the assembled bearing. The



assembled bearing is usually mounted on an arbor, Figure 2, having a slight taper (.0001″ to .0002″ on the diameter per inch of length) and the radial run-out indicated as shown. The radial run-out is the difference between the minimum and maximum readings obtained when rotating the outer race one revolution, with the arbor stationary for outer race radial run-out, or rotating the arbor one revolution with the outer race stationary for inner race radial run-out.

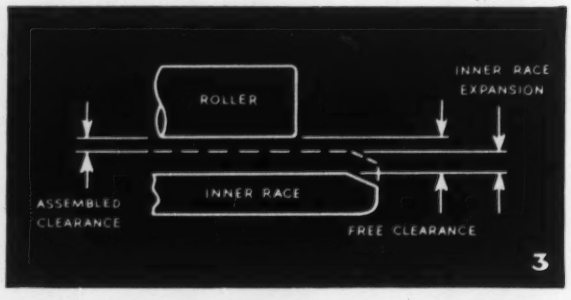


2. UNIFORMITY OF ROLLER DIAMETERS

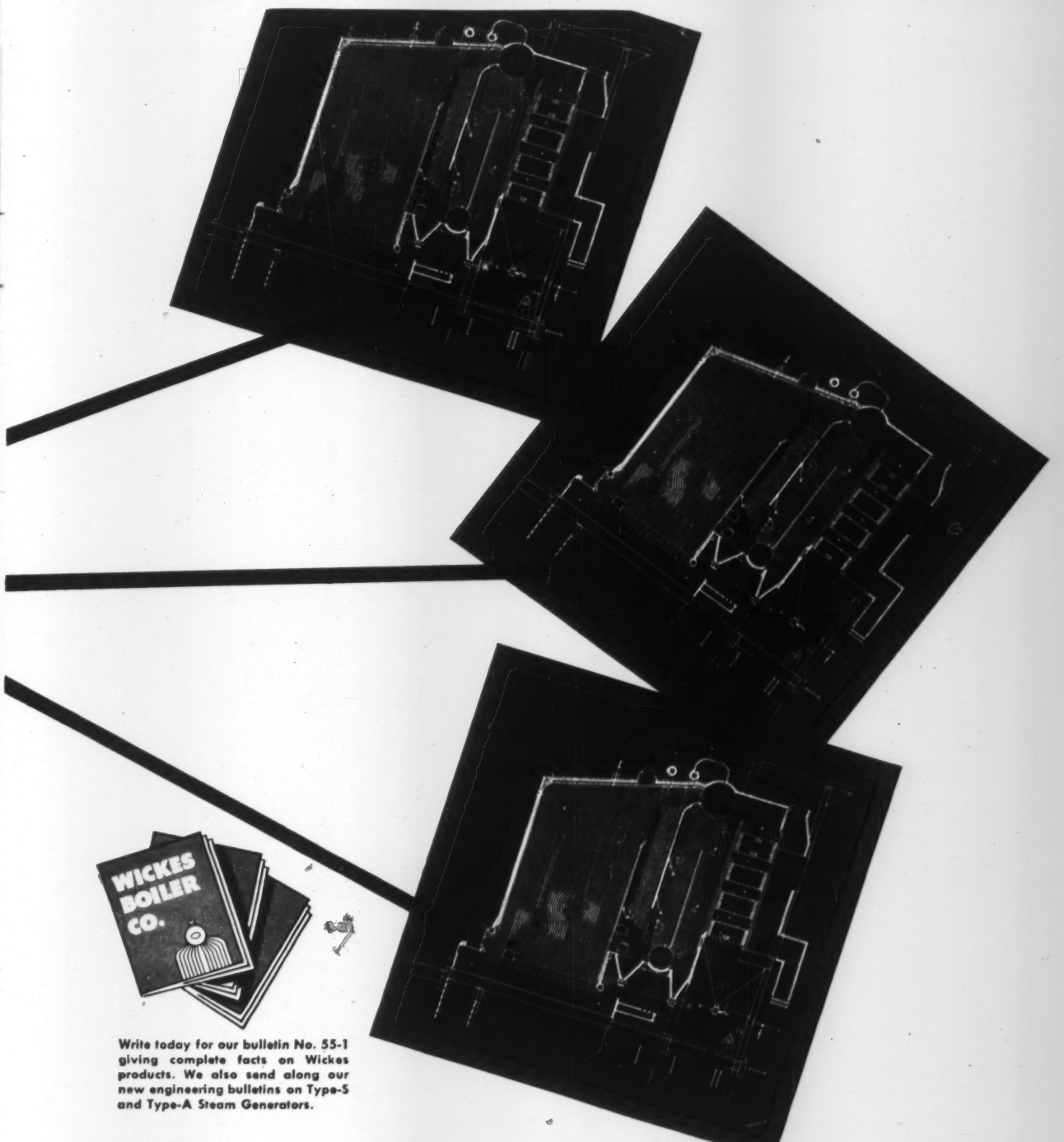
Another factor governing running smoothness is *roller diameter uniformity*. This is usually obtained by segregating the rollers into diameter variation classes of .00005″, .0001″, or .00015″, depending on the bearing size and the nature of the application, and assembling only rollers of the same group into a given bearing. Gauging for this segregation necessarily rejects excessive taper.

Uniformity of roller diameters is important for another purpose. It provides the user with a bearing in which the internal diametral clearance is controlled within the closest possible limits. The rollers are matched with races which are segregated for pathway size in a fashion similar to the rollers, usually to twice the diameter limits of the rollers. The internal clearance can thus be manipulated at will by combining various diameter classes of races and rollers; but once a particular range is selected, it will remain constant within the combined limits of the roller and race pathway diameter limits. Here, again, a tapered condition of the race pathway is automatically rejected.

Obviously, the internal clearances of commercial bearings must be standardized for the practical reasons of cost and availability, but the clearance values have been so selected that under the specified fits the *running* clearance is at the most desirable minimum, depending on bearing type and size. Figure 3 (magnified).



DEPARTMENT INSTALLS THREE TYPE R STEAM GENERATORS

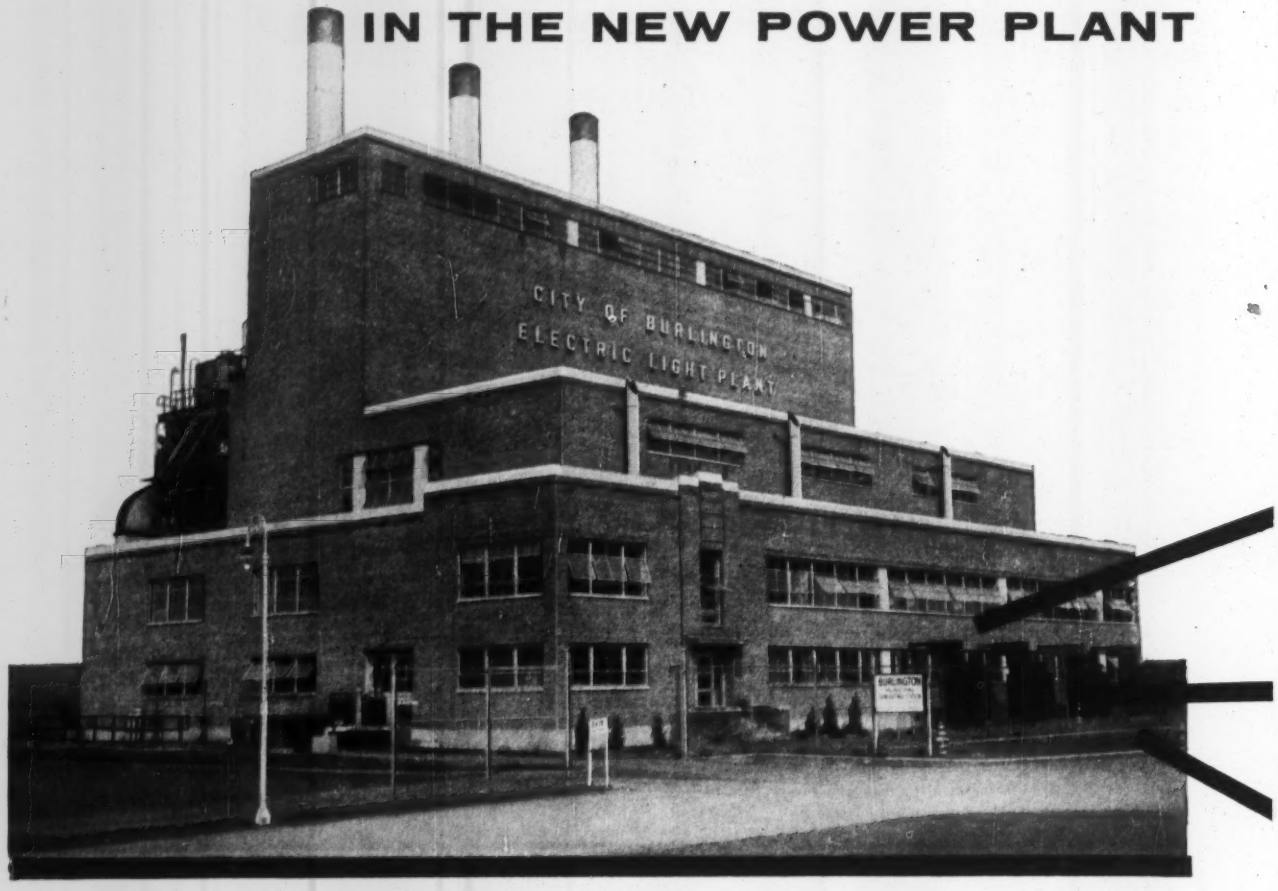


Write today for our bulletin No. 55-1 giving complete facts on Wickes products. We also send along our new engineering bulletins on Type-S and Type-A Steam Generators.

RECOGNIZED QUALITY SINCE 1854 • ***SALES OFFICES:*** Albuquerque, N.M. • Boston • Buffalo • Charlotte, N.C. • Chicago • Cleveland Dallas • Denver • Detroit • Fort Wayne, Ind. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City Portland, Ore. • Saginaw • Salt Lake City • San Francisco • Springfield, Ill. • Tulsa • Washington, D.C.

164

BURLINGTON, VT. ELECTRIC LIGHT 100,000 LBS. PER HOUR WICKES IN THE NEW POWER PLANT



At the modern plant of the Burlington, Vermont Electric Department, three Wickes type R steam generators provide a powerful and unfailing steam supply. Each unit delivers 100,000 pounds of steam per hour, contains 7480 square feet of boiler heating surface, and 2320 square feet of water wall heating surface. Each steam generator is equipped with a superheater, airheater and economizer. These boilers have a design pressure of 1000 psi. This modern plant is operated by the Green Mountain Power Corporation. Superintendent of Burlington's Electric Light Department is W. A. Stebbins.

THE WICKES BOILER CO.

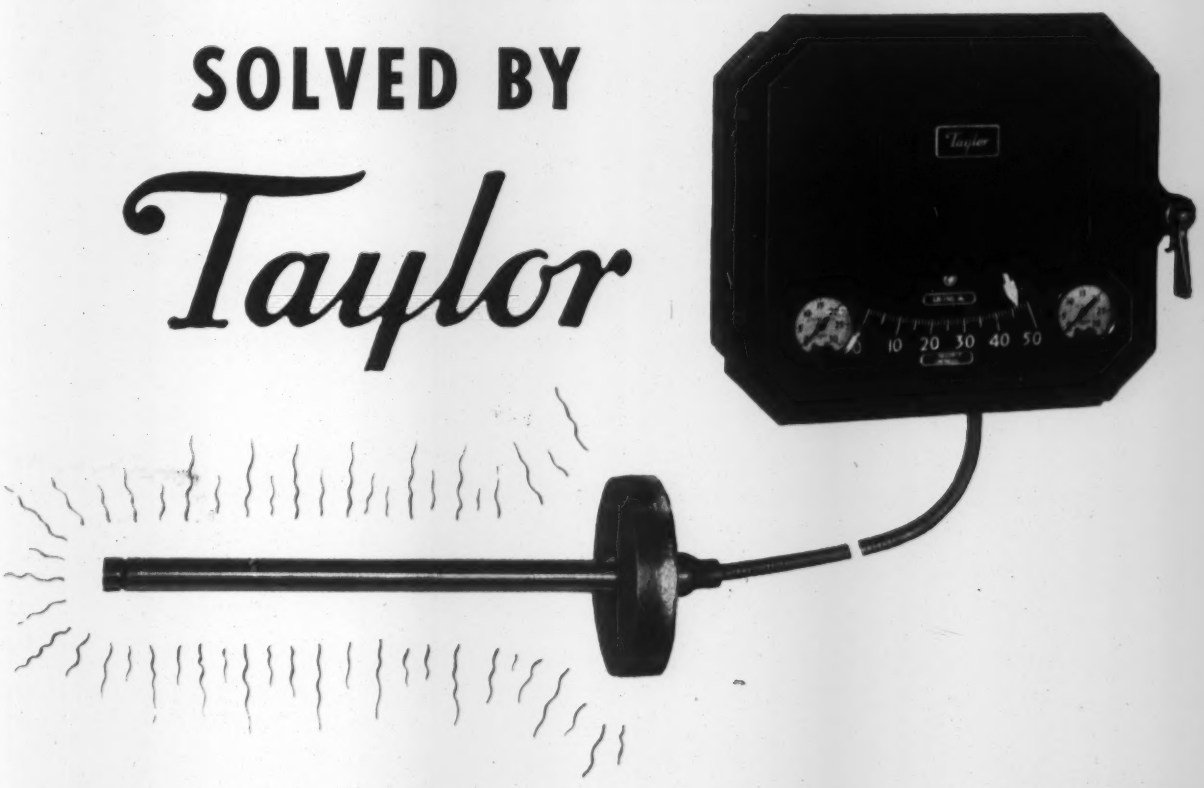
DIVISION OF THE WICKES CORPORATION

SAGINAW, MICHIGAN

ANOTHER RED HOT PROBLEM

SOLVED BY

Taylor



Accurate measurement of process *pressures* at temperatures up to 1500° F.

THE RED portion of this picture shows another example of Taylor ingenuity at work. It's a volumetric pressure measuring system for use at extremely high temperatures. Although designed primarily for atomic energy applications, it has since been adapted for a variety of applications in measuring pressures of liquid metals.

Built to meet tremendously severe requirements, this system will measure pressures at temperatures up to 1500°F., *to the accuracies usually associated with measurement at atmospheric temperatures.* And it will measure short ranges that would be subject to considerable error with conventional systems.

Seventy-five of these units have been installed to date, and all are working satisfactorily . . . a tribute indeed to the vision and ingenuity of Taylor engineers and the dependability of instrumentation bearing the Taylor name.

Whether or not *your* instrument problem has anything to do with measuring pressures of molten metals, it's probable that we can find the answer. Just call your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

Any length of span is permissible between the limits of 50 and 600 psi. Suppression of 100% up to 0-300 psi. The system shown uses a 5-ply corrugated diaphragm, 4" O.D. In addition to the Taylor indicator shown above, it can be used with recorders, controllers and dial type indicators.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

result of an engineer's good common sense

Pre-fabrication saves time, space and money when B&W Seamless Welding Fittings are used!

The engineer on this job knows his business. He specified B&W Seamless Welding Fittings and arranged for pre-fabrication. Think of the time, space and money he's saving management.

And there's no question of the pre-fabricated sections fitting when they're ready to be installed, because they're dimensionally accurate. Full radius, true circularity and smooth walls of exact thickness permit fast alignment and easy fit-up.

This time, specify B&W Seamless Welding Fittings for a permanent, leakproof piping system. Seamless Welding Fittings allow piping to nest closer, are stronger, yet weigh considerably less than other types of fittings. They're available in a complete range of sizes and types in carbon and the B&W CROLOYS.

THE *NATURAL* SOURCE FOR ALLOY FITTINGS

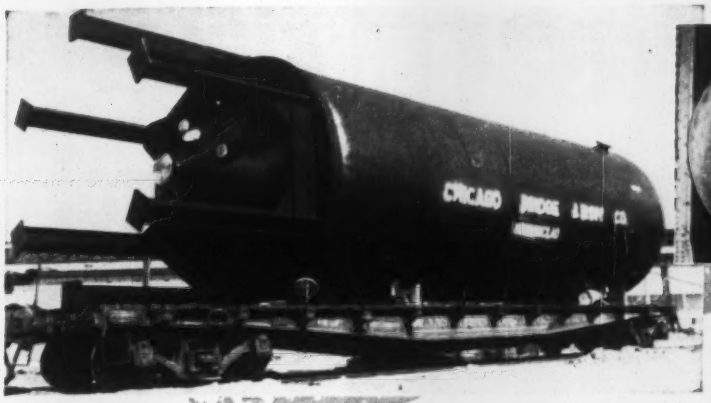
B&W

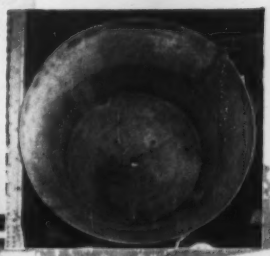
TUBULAR PRODUCTS DIVISION

FA-7905-FE

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
3839 WEST BURNHAM STREET • MILWAUKEE 46, WISCONSIN

Seamless welding fittings and forged steel flanges, seamless and welded tubular products — in carbon, alloy and stainless steels.





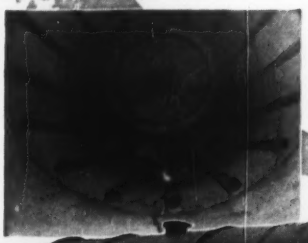
Left: 12-ft. O.D. by 43-ft. 4-in. digester with 316 E. L.C. Hortonclad. Inset: Interior of vessel built for Hudson Pulp and Paper Co. at Palatka, Florida.

HORTONCLAD and CB&I VESSELS

High Vacuum Brazing Process Assures Uniform Thickness of Clad Layer

Hortonclad®, available only with CB&I process and storage vessels, is a composite metal having an integral and continuous bond produced by a high vacuum brazing process. Uniform thickness is assured as the alloy cladding and the backing are in their final thickness before bonding. Hortonclad meets all ASME Boiler and Pressure Vessel Code and API-ASME Unfired Pressure Vessel Code requirements.

CB&I vessels can be fabricated using Hortonclad plates with silver, monel, Inconel, Hastelloy, stainless and a wide variety of other metals and alloys. Complete information on Hortonclad and its use with CB&I vessels may be obtained by writing our nearest office.



Above: A 36-ft. 9 15/16-in. shell section of this 43-ft. reactor has type 405 stainless steel Hortonclad. Inset: View inside of reactor supplied to the Derby Oil and Gas Co., Wichita, Kansas, through the Fluor Corp.

Above: 37¼-in. O.D. by 24-ft. 10¾-in. urea autoclave liner with fine silver Hortonclad. Inset: View of interior.

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
New York • Philadelphia • Pittsburgh • Salt Lake City • San Francisco
Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

CB&I

OILITE

IN AN AUTOMATIC WASHER HELPS BUILD CUSTOMER SATISFACTION -YET COSTS NO MORE

OILITE bronze agitator shaft bearing
OILITE bronze upper center post bearing
OILITE bronze rubber-mounted lower center post bearing
OILITE bronze thrust washers (2)
OILITE bronze pulley bearing
OILITE bronze thrust bearing
OILITE bronze water pump bearing
Photos courtesy Whirlpool-Seeger Corporation St. Joseph, Michigan

Another cost-saving application of **Amplex Powder Metallurgy**

Quality is a *must* for trouble free operation, continued customer satisfaction. And quality depends upon the excellence of every part, every component. For many years Whirlpool-Seeger has used OILITE center post bearings, agitator shaft bearings, water pump bearings and pulley bearings in their automatic washers. Whirlpool-Seeger uses these and other OILITE parts for very good reasons.

First of all, the manufacturer knows OILITE heavy-duty bronze bearings will meet specifications. Chrysler-Amplex precision production assures him OILITE bearings capable of carrying their loads safely, surely and quietly.

Then too, Chrysler-Amplex plant and facilities—largest and most complete of any in the metal powder fabrication industry—promises on-time deliveries in any quantity.

Moreover, in using OILITE bearings the manufacturer selects a product his customers know and respect for superior engineering.

Finally, this manufacturer, like a great many others, finds OILITE bearings—despite all their advantages—cost no more.

Chrysler-Amplex representatives and dealers are located in principal cities in United States and Canada. Let the nearby representative help you. Find him in the yellow section of your telephone directory under—"Bearings—OILITE."

Representatives and dealers located in principal cities in United States and Canada.

A CHRYSLER OILITE PRODUCT

Only Chrysler Makes **OILITE**

AMPLEX DIVISION

CHRYSLER CORPORATION • DETROIT 31, MICHIGAN

It's New! It's Free!

S-56 Standard OILITE Bronze Bearing Stock List. All standard sizes—over 1000 sleeve, flange and thrust bearings, cored, bar and plate stock—are listed in this handy, easy-to-use booklet. Write for your copy today. Address: Dept. IE, Chrysler-Amplex Division, P.O. Box 2718, Detroit 31, Michigan.

Bearings • Finished Machine Parts • Permanent Metal Filters • Friction Units

Ferrous and Non-Ferrous Metals

still the winner

... and in high speed steels, nothing beats REX

The winner and still champion after fifty years is Crucible's REX high speed steel. *And now it's better than ever!* Recent improvements in manufacturing processes have given even higher quality and greater uniformity to every one of its properties.

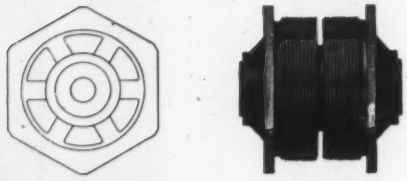
Why not shop test the new REX yourself? Test it for size, structure, response to heat treatment, fine tool performance. Give it any test you wish. You'll see why it is today, as it has always been — *the standard by which all other high speed steels are compared.*

Ask for REX by name at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for information on REX, and the other Crucible special purpose steels, send for the *Crucible Publication Catalog. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

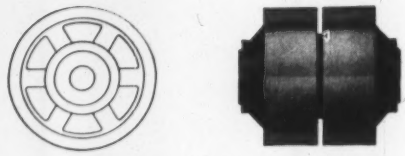
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Special MB mounts give damped vibration control



Threaded flange or press-in types available in MB damped vibration isolators.

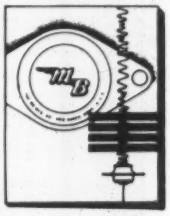


What to do when low frequencies cause resonance in vibration isolators? That was the problem put to MB engineers by one company. Stiffer mounts had been tried. But these reduced isolation of higher frequency vibrations and caused malfunctioning of the sensitive product.

New, type 121 MB mounts supplied the answer. These units minimize low frequency resonances through a unique internal damping design without any sacrifice of high frequency isolating efficiency. They restrict resonant build-up to below 3.5 to 1 *in any direction of vibration.*

Three sizes are now available to you, in threaded or press-in types. All meet military specifications on vibration and shock. Metal parts interlock, totally enclosing and protecting damper. Load ranges: from 15 to 100 pounds per unit.

Satisfying special vibration control needs has been MB's business for over 15 years. Take advantage of this fund of busy and successful experience. Check with MB for special-performance mounts available as standard units.



BULLETIN NO. 616 gives useful, helpful data on vibration. Send for your copy to Dept.

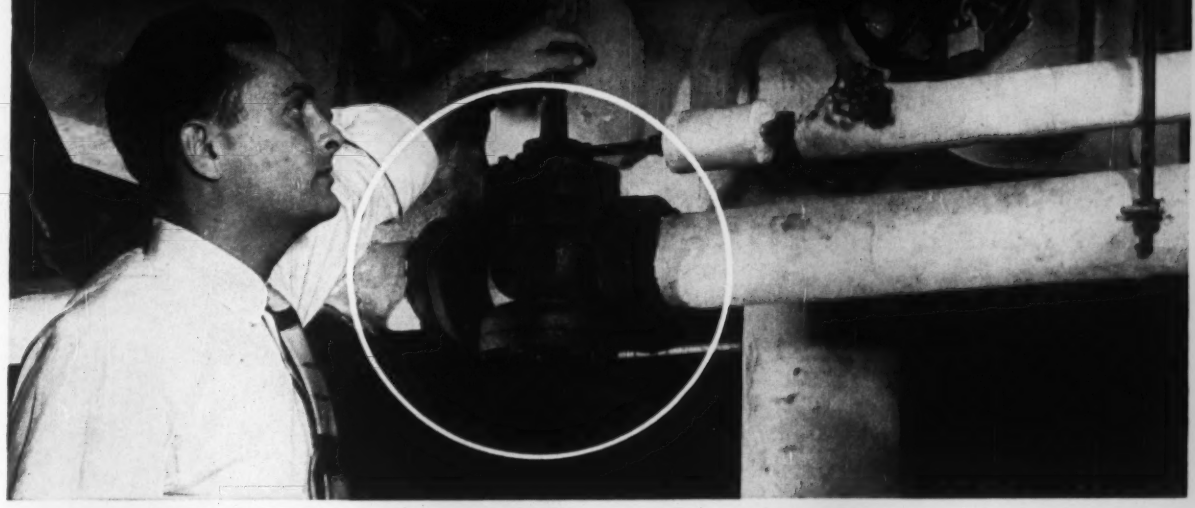
MB *manufacturing company* 1074 State Street, New Haven 11, Conn.

A division of Textron Inc.

PRODUCTS TO ISOLATE VIBRATION . . . TO EXCITE VIBRATION . . . TO MEASURE VIBRATION

PROVEN PERFORMANCE

at A. E. STALEY Mfg. Co.

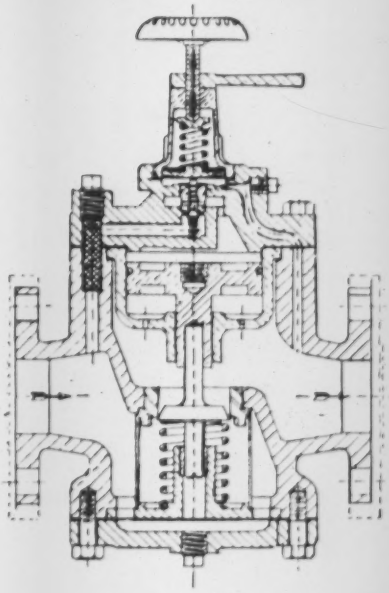


CASH STANDARD Type 44

Pressure Reducing and Regulating Valve for Steam Service

Sudden changes in the requirements for hot water in the employees' shower rooms at the **Staley** plant demand full capacity range operation of the regulating valve with precise control of downstream pressure.

In April of 1956, a CASH STANDARD Type 44 Steam Valve was installed in the line supplying steam to the heater. **Gerald Hammond**, instrument engineer at **Staley**, reports: "The CASH STANDARD Type 44 has given exceptionally good service—the kind of service we expect from all CASH STANDARD products. It has required no maintenance since installation eight months ago."



What's your control problem? Use this dependable steam valve.

Built in Pilot and Main Valve Strainers • Internal Pilot-Operated, Piston-Actuated • Single Seat • Highly Sensitive, Responsive to Smallest Changes in Reduced Pressure • Maximum Inlet Pressure 250 PSI @ 400°F. • Delivery Pressure 5-250 PSI • Available with External Sensing Line • Sizes 2", 2½", 3", 4".

For an individual solution to your control problem, contact the CASH STANDARD specialist in your area, or write Dept. C

CASH **CS** **STANDARD**

A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
P. O. Box 551, Decatur, Ill.

PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS

From Regina to Saudi Arabia

B-L VESSEL LININGS SET RECORD AFTER RECORD FOR DEPENDABLE PERFORMANCE

It looks like a Cook's Tour—but it isn't. Instead it's a listing of recent Bigelow-Liptak refinery installations in far-flung corners of the world.

There are good, solid reasons for this world-wide preference for Bigelow-Liptak jobs. In the first place from B-L's years of experience has come a complete castable package. Insulating- and abrasion-resistant castables are engineered, furnished and installed by the same company—which means just one contract and one responsibility.

The overall result of this all-in-one engineering is exceptional durability and performance. B-L refractory installations have established world records for continuous operation. For example, after initial runs of 785 and 610 days, B-L linings were in perfect shape—required no repairs during shutdowns.

Yes, from Regina to Saudi Arabia—and points in between—Bigelow-Liptak installations are setting new records for service and performance. For complete information write for the B-L catalog "One Source". Do it today!

A FEW OF OUR RECENT JOBS

Montreal, Canada	Regenerator
Regina, Canada	Regenerator and Cyclones
Batangas, Philippines	Regenerator and Cyclones
Yokohama, Japan	Regenerator—Reactor
Ras Tanura, Saudi Arabia	Kiln-Reactor
Copenhagen, Denmark	Kiln
Antwerp, Belgium	Regenerator and Cyclones
Norco, La.	Reactors
Altona, Australia	Regenerator and Cyclones
Mandan, North Dakota	Regenerator, Reactor,
Anacortes, Washington, U.S.A.	Cyclones and Lines.

BIGELOW-LIPTAK *Corporation*

AND BIGELOW-LIPTAK EXPORT CORPORATION
2550 WEST GRAND BOULEVARD, DETROIT 8, MICHIGAN

UNIT-SUSPENDED WALLS AND ARCHES

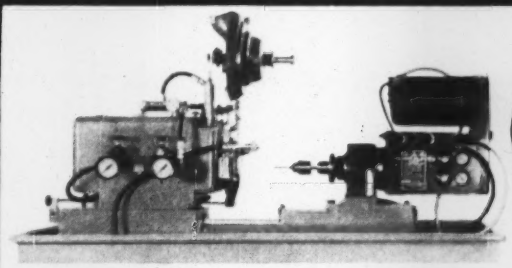
In Canada: BIGELOW-LIPTAK OF CANADA, LTD., *Toronto, Ontario*

ATLANTA • BOSTON • BUFFALO • CHICAGO • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO • LOS ANGELES • MIAMI • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TULSA • MONTREAL • SAULT STE. MARIE, ONT. • VANCOUVER • WINNIPEG

and Now! ---- CARTAGENA, COLOMBIA

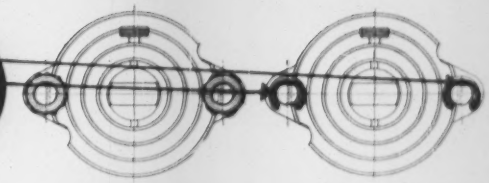
All of the castable refractories required for a complete cat cracker—including a regenerator and reactor and the interconnecting lines—will be furnished by Bigelow-Liptak for a job now going up at Cartagena, Colombia. In addition, B-L will furnish erection help and supervision.

Waldes Truarc Retaining Rings Eliminate Machining and Parts—Cut Assembly Time on Drill and Tapper



Beco Model 410 Drill and Tapper

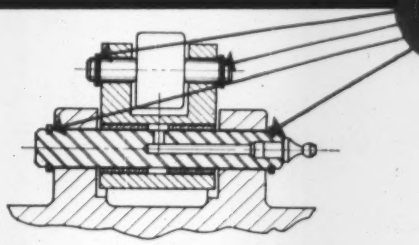
The Batchelder Engineering Co., Inc., Springfield, Vermont uses 4 different sizes of 2 different type Waldes Truarc rings in their new BECO Model 410 Automatic Drill and Tapper. Truarc rings speed assembly, reduce machining, improve design.



ALTERNATE DESIGN TRUARC DESIGN

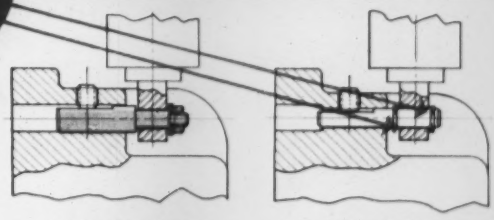
Clamp Cylinder Rod Stop Assembly

Truarc "E" Rings (Series 5133) replace stop nuts in the Clamp Cylinder assembly. They eliminate need for threading 2 rods ...the danger of cross-threading nuts...and costly rejects. Truarc Rings cut assembly time and cost.



Bell Crank Pivot Assembly

Truarc Rings (Series 5100) in Bell Crank Pivot assembly permit grease hole not possible with cotter pin fastener. Use of nuts would have increased machining and assembly costs considerably.



ALTERNATE DESIGN TRUARC DESIGN

Hopper Cylinder Anchor Pin Assembly

2 Truarc Rings (Series 5100) secure and position end of vertical air cylinder. Rings eliminate extra cost of machining 3 diameter pin, threading and undercutting...plus nut and washer. Assembly is quick and sure.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types...as many as 97 different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!

WALDES

TRUARC®

RETAINING RINGS

WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

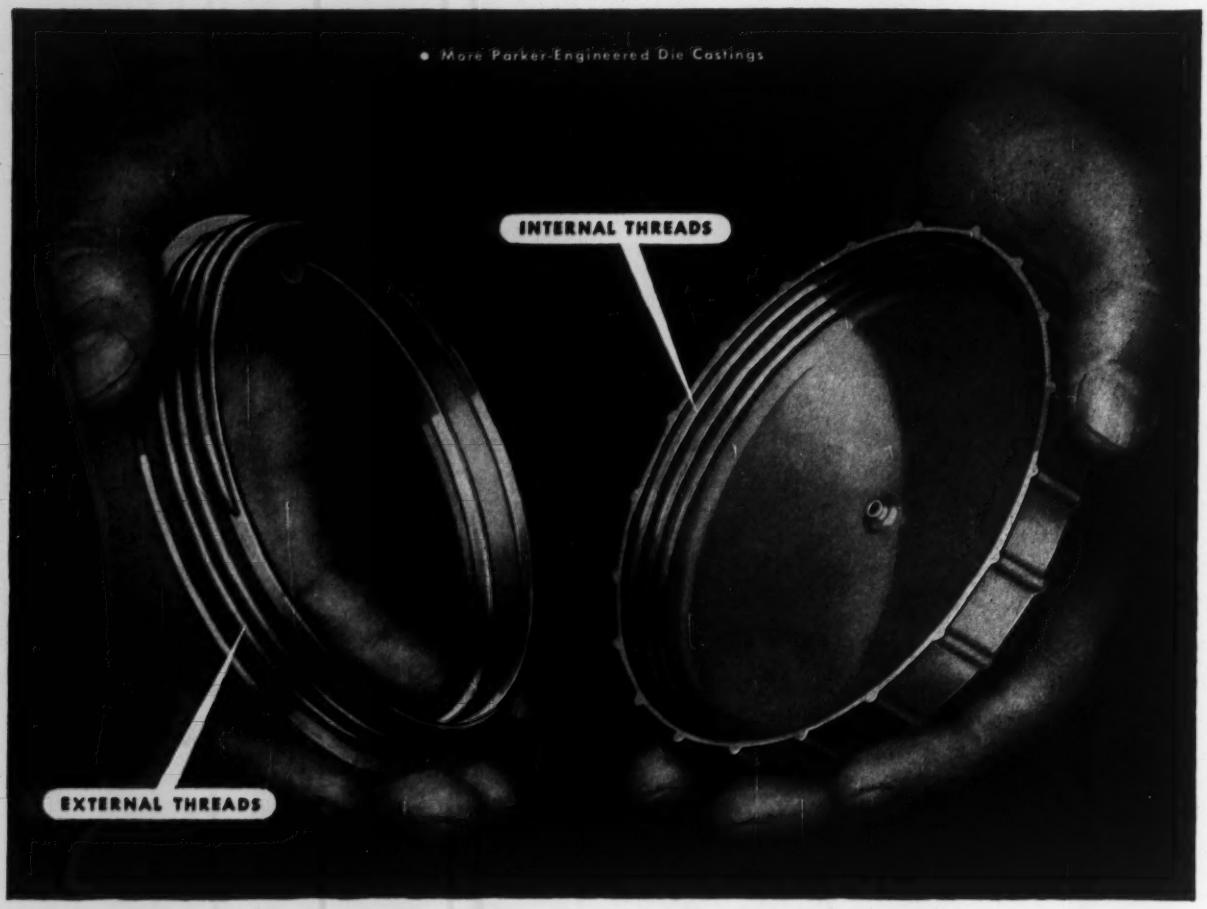
Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N.Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

Name .....
Title .....
Company .....
Business Address .....
City ..... *Zone* *State* .....

MEO19

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

• More Parker-Engineered Die Castings



From ONE Die: TWO Parts... THREE Savings!

PARKER SALES ENGINEERS

CHICAGO 49, Ill.
Ollie J. Berger Company • 2059 East 72 Street

CINCINNATI, Ohio
William H. Broxterman • 2174 Buck Street

DETROIT 35, Mich.
Hodgson-Geisler Co. • 18917 James Couzens

GIRARD, Penna.
Daniel F. Marsh • 35 Chestnut Street

KIRKWOOD 22, Mo.
Edward F. Higgins, Jr. • 102 West Adams Street

WILTON, Conn.
Girard L. Palmer • Belden Hill Road

SYRACUSE, N. Y.
J. C. Palmer • 712 State Tower Bldg.

BELLEFONTE, Penna.
Warren G. Olson • 420 East Linn Street

These two mating parts, including the threads, are cast simultaneously in the same die. The result—three savings:

1—One die instead of two *saves die cost*

2—Casting two parts at one time in the same die *saves production time*

3—Precision casting of the perfectly mated threads with no parting line *saves machining cost*

Together, these three savings result in a substantially lower cost per piece. Just another example of the way Parker-engineered die castings save you money.

Parker has been a leader in die casting for over 50 years—an old hand with new ideas. This skill and experience can solve problems — and save money—on *your* component parts. Just call the nearest Parker sales engineer or write the factory direct.

Parker White Metal Company • 2153 McKinley Ave., Erie, Pennsylvania

PARKER

high pressure ALUMINUM and ZINC die castings POWDERED METAL PARTS

Volume 79 • Number 1

JANUARY 1957

•

Published by

The American Society of Mechanical Engineers

Officers of the ASME

W. F. Ryan, *President*
J. L. Kopf, *Treasurer*
C. E. Davies, *Secretary*
E. J. Kates, *Assistant Treasurer*

Editorial Department

George A. Stetson, *Editor Emeritus*
J. J. Jaklitsch, Jr., *Editor*
E. S. Newman, *News Editor*
J. Foster Petree, *European Correspondent*
L. S. Blodgett, *Consulting Editor*

Advertising Department

S. A. Tucker, *Publications Business Mgr.*
M. H. Marty, *Business Manager*
N. M. Losef, *Asst. Business Manager*

Publications Committee

W. E. Reaser, *Chairman*
Kerr Atkinson
John de S. Coutinho
B. G. A. Skrotzki
Hendley N. Blackmon
H. N. Weinberg, N. J. Viehmann } *Junior Advisory Members*

Regional Advisory Board

Roy L. Parsell—Region I
Glenn R. Fryling—Region II
F. J. Heinze—Region III
Francis C. Smith—Region IV
H. M. Cather—Region V
C. R. Earle—Region VI
M. B. Hogan—Region VII
Linn Helander—Region VIII

Published monthly by The American Society of Mechanical Engineers. Publication office at 20th and Northampton Streets, Easton, Pa. Editorial and Advertising departments at the headquarters of the Society, 29 West Thirty-Ninth Street, New York 18, N. Y. Cable address, "Mechaneer," New York. Price to members annually $3.50 for initial membership subscription, $5.60 for additional subscriptions, single copy 50 cents; to nonmembers annually $7.00, single copy 75 cents. Add $1.50 for postage to all countries outside the United States, Canada, and the Pan American Union. Changes of address must be received at Society headquarters seven weeks before they are to be effective on the mailing list. Please send old as well as new address. . . By-Laws: The Society shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B13, Par. 4). . . . Entered as second-class matter at the Post Office at Easton, Pa., under the Act of March 3, 1879. . . . Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on January 17, 1921 . . . ©Copyrighted, 1957, by The American Society of Mechanical Engineers. Member of the Audit Bureau of Circulation. Reprints from this publication may be made on condition that full credit be given MECHANICAL ENGINEERING and the author and that date of publication be stated.

MECHANICAL ENGINEERING is indexed by the Engineering Index, Inc.

MECHANICAL ENGINEERING

1956—Then What?. . . . . *J. W. Barker* 4
Arnold Engineering Development Center . *J. M. Wild* 8
Metallurgical Yield-Stress Observation . *J. W. Jacobson* 13
The Role of the Mechanical Engineer—in Rubber, Petroleum, and Chemical Industries . . . . . *D. R. Scheu, M. R. Born, and W. E. Chandler* 16
EJC and Affiliate Member Societies . . . *E. P. Lange* 20
Utilization of Lignite . *E. C. Miller and C. F. Hawley* 23
Recent Technical and Economic Developments in Western Europe. . . . . *F. S. Blackall, jr.* 27
The ASME Council Reports Activities in 1955–1956. . 55
ASME Honors Engineers 68
1956 ASME Annual Meeting. 75
Availability List for 1956 ASME Annual Meeting Papers 95

Editorial 3
Briefing the Record 31

Nuclear-Reactor Shell Stresses, 31; Experimental Nuclear Reactor, 32; Nuclear Briefs, 33; "Sneaky Peeky," 34; Aluminum-Bronze Alloy, 34; Sintering, 35; Alumina From Clay, 36; Electronically Controlled Milling Machine, 36; Missile Tester, 37; Bearing and Lubricant Center, 38; Motion Pictures of Metal Fatigue, 38; University Computer Center, 40; Solar Furnace, 41; Ultrasonic Soldering Iron, 41; "Delrin" Acetal Resin, 41; Photo Briefs, 42

European Survey 44

Boring Machine, 44; Cavitation in Water Turbines, 45

ASME Technical Digest 46

Petroleum Mechanical Engineering, 46; Gas Turbine Power, 48; Instruments and Regulators, 49; Lubrication, 50; Fuels, 52; ASME Transactions for December, 1956 (*Journal of Applied Mechanics*), 54

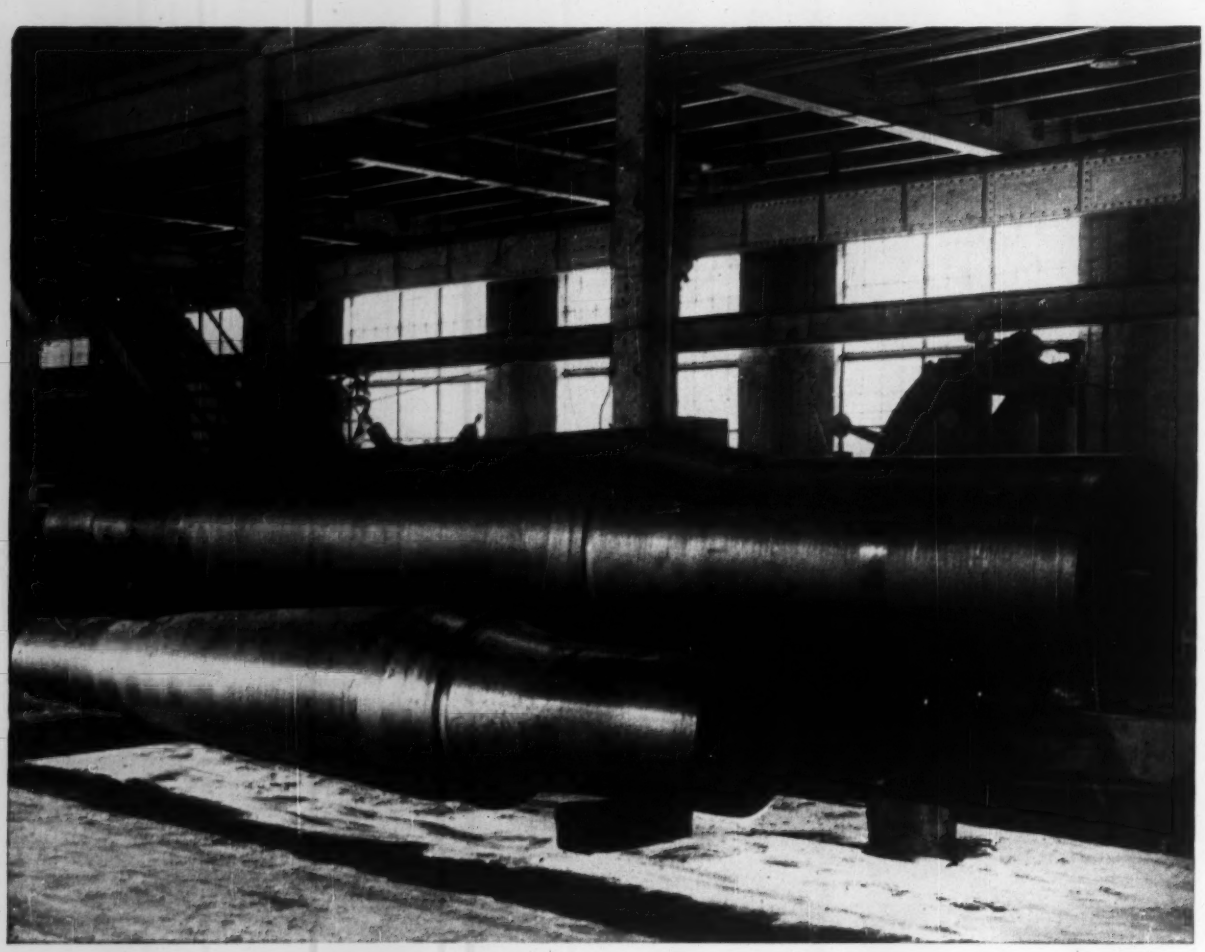
Reviews of Books 99
Roundup 101

AICE Annual Dinner, 101; Meetings of Other Societies, 101; ARS Annual Meeting, 102; UET Report, 103; Heidelberg Control Meeting, 105; Business Forecast, 106; People, 107; Coming Meetings, 108; Edison Foundation Institute, 109; Nuclear Energy Standards, 111; Aircraft Hydraulic Conference, 111; Small Nuclear Plants, 111; Developments in Metallurgy, 112; Oil or Uranium, 113

ASME News 114

1957 Nuclear Congress, 114; EJC General Assembly, 114; O. B. Schier, 2nd, ASME Deputy Secretary, 115; ASME Coming Events, 115; ASME Southern California Section, 116; Junior Forum, 117; New ASME Committees, 118; Freeman Fellowship, 118; Woman's Auxiliary, 119; Personnel Service, 122; Candidates, 124; Obituaries, 126

Keep Informed . . . 41 *Consultants* 166
Classified Advertisements 145 *Advertisers* 168



*Forged from 3½% Nickel Steel — These gyratory crusher shafts weigh 102,000 and 34,000 lbs. and are 25 and 17 feet long respectively. They were produced by Bethlehem Steel Company, Steelton, Pa.

*In large forgings like this...**

You get desired properties reliably with Nickel Steel

Usually husky parts like this cannot be quenched without special facilities.

How then do you get the superior mechanical properties often required in heavy-sectioned parts?

By selecting a nickel alloy steel that doesn't need a liquid quench to develop strength and toughness.

Why Nickel?

The tests of time and laws of metallurgy have proved nickel to be most valuable in developing high mechanical properties in heavy forgings. Nickel, often acting with other alloying elements, increases the hardening response of steel parts too large to liquid quench. The resulting microstructure formed gives added strength and improved toughness.

Do you have a problem?

Nickel alloy steels are used for dependable trouble-free performance in the most demanding applications. Send us the details of your problem. We may be able to help you — write today.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.

Volume 79 • Number 1

JANUARY 1957

MECHANICAL ENGINEERING

George A. Stetson, *Editor Emeritus*
J. J. Jaklitsch, Jr., *Editor*

Free Exchange of Knowledge . . .

THE free exchange of knowledge as practiced in the United States was forcibly demonstrated during the 1956 ASME Annual Meeting held Nov. 25–30, 1956, in New York, N. Y. The technical program was crammed with some 250 engineering papers, reports, symposiums, and panel discussions which had to be presented at as many as 11 simultaneous sessions, mornings, afternoons, and evenings. In addition, the International Conference on Fatigue of Metals was held during the meeting. This conference, which contained 80 papers, was sponsored by The Institution of Mechanical Engineers with the co-operation of ASME and served to point up the strong bond which exists between ASME and IMechE in co-operatively exchanging engineering knowledge. Concurrently the American Rocket Society, an affiliate of ASME, held its Annual Meeting during the same week—another way in which ASME promotes the dissemination of technical information. The ARS program included 48 technical papers.

Of the 250 papers on the ASME program, 222 were available in pamphlet copy form by the time the meeting got under way. This, by the way, was a remarkable achievement and the participating Divisions, papers review committees, and program-making agencies are to be congratulated on the special effort made to adhere to deadline dates for receipt of papers for the meeting. Deadline dates are necessary so that copies of papers will be available in advance of the meeting to provide opportunity for members who wish to take part in the discussion to do so intelligently. The Publications Committee has continually emphasized the need for maintaining deadline dates for receipt of meetings papers, and the Committee's efforts in this direction have proved to be fruitful. It is to be hoped that even greater improvements will be forthcoming.

The Meetings Committee also is to be commended for its fine job in scheduling and co-ordinating the complex program which made up the Annual Meeting.

It is all-embracing programs such as these that form the backbone of the free exchange of knowledge and lead us up the . . .

. . . Path to the Future

. . . which in turn can only lead to better engineering techniques, new technological developments, and, far more important, a place where engineers and scientists can discuss freely technical data which they would make available to other engineers and scientists and the general public.

A glance at the news account of the meeting and the Availability List of Papers published in this issue gives a good idea about the content and conduct of the meeting. The many technical papers and luncheon and dinner addresses, it should be noted, while on a variety of subjects, had a similar theme—progress! For example, the Society's strong position in the new field of atomic power was clearly evidenced by the great interest that attendees at the meeting showed in the joint Nuclear Engineering and Power Division sessions at which the features of six nuclear power stations were described. Included were the 134,000-kw Yankee Atomic Electric Plant; the 180,000-kw Dresden Nuclear Power Station; the proposed 140,000-kw Consolidated Edison Nuclear Plant; the 156,000-kw Enrico Fermi Atomic Power Plant; the proposed 75,000-kw reactor for the Consumers Public Power District of Nebraska; and the Pennsylvania Advanced Reactor which is leading to the design of a 150,000-kw plant. When ultimately completed, these stations will represent a sizable quantity of nuclear kilowatts and point up the definite progress being made toward using the atom as a future competitive power source.

Another significant step in the field of power was recorded with the presentation of details of the new supercritical pressure Eddystone Plant being built for the Philadelphia Electric Company. The plant will use 5000-psi 1200-F steam to produce 325,000 kw of electricity—again remarkable progress pointing the way toward future conventional fuel-burning steam-generating station design.

At the Management sessions, overflow audiences comprised of present and future engineering managers and administrators, listened attentively as experts discussed such topics as concepts of manager development in engineering enterprises and planning an engineering project. More than ever, engineers are becoming involved in managerial and administrative positions. And as one views the growing complexity of our technology it is vital that management turn to engineers to carry out many of its important administrative functions.

There were, of course, many other outstanding technical developments noted at the meeting—far too numerous to include in this space—but either singly or in total they all contribute new knowledge that is so necessary to negotiate the path of the future.

The ASME paused to pay tribute . . .

. . . to George A. Stetson, editor emeritus of the Society's periodical publications, during the 1956 Annual Meeting Banquet. In his acceptance remarks, incoming ASME President W. F. Ryan's public acknowledgment of the accomplishments of Mr. Stetson in making the Society's technical publications rank among the most useful and sought after in the world was enthusiastically received. As editor emeritus of ASME, Mr. Stetson is busily engaged in the preparation of a history of the Society. He is also carrying on the necessary editorial functions for the Transactions of the ASME.

meeting was over! What a wonderful experience that was.

Restudy of Regions

The growth of our membership, when considered also with the problems of vice-presidential visits and the distances involved in Regional Administrative Committee Meetings, makes a restudy of our regional territorial assignments highly desirable. Certainly three of our regions are now too extensive in area to be covered easily and effectively by their respective vice-presidents. The main rail and plane transportation routes are in general east-west, and this fact should be taken into account in any redistricting. It may well be that we shall have to consider increasing the number of regions from eight to nine or even ten, which also would have an effect upon the size of the Council. Or it might be more advisable to authorize assistant vice-presidents (in some or all of our regions) who would be ex-officio members of the Regional Executive Committees and who would supervise and visit, under the general direction of the vice-president, the Sections and Branches, and hold in subareas of the region the Regional Administrative Committee meetings. They might then be potential candidates for consideration as regional vice-presidents. Our Organization Committee is studying these problems and will make such recommendations as seem most desirable and possible of execution. During these studies I am certain that the chairman of the Organization Committee will be glad to receive any suggestions from our members.

Meetings

As I indicated in "A Message from the President" sent to all members on Nov. 12, 1956, our ASME Professional Division Conferences have developed into one of our most important technical activities. Under the enthusiastic inspiration of the Professional Division Executive Committee and the hard-working leadership of each Division's chairman, these Conferences have been outstandingly successful. These leaders deserve the heartiest praise of our members.

Cutting, as the Divisions do, vertically through our entire membership, these Conferences serve presently two most important functions: (1) They bring together our members for presentation of papers with special fields of interest; and (2) they minimize tendencies to form splinter societies. Their very success raises now the question whether the time has not arrived to consider seriously making these Conferences the principal theaters for the presentation of all our highly technical papers. The Society might abandon the Spring and Fall National Meetings where in recent years the attendance has not been national in character and has been relatively small compared to the Semi-Annual and Annual National Meetings. The time, effort, and expense connected with these Spring and Fall National Meetings might be more advantageously employed in expanding the Professional Division Conferences to make them the platform on which the highly technical papers in the specific field of the Division concerned would be initially presented and informally discussed. Might this not assist in relieving the present tremendous pressures for multiple parallel sessions at our Annual and Semi-Annual National Meetings? One has only to glance at the program for this Annual Meeting to realize the magnitude of these pressures. Another glance at the program will convince you that our National Meeting programs are so complex as to make it difficult for any member attending a meeting to hear or to participate in any wider technical fields than he would in his own Professional Division Conferences.

Presentation of Papers

Our Meetings Committee has been struggling for years to deal with the increasing complexity of our National Meetings, to accommodate the flood of papers and to attempt to improve the quality of technical papers recommended for presentation. Our Publications Committee, at the same time, has faced difficult financial and editorial problems arising from this very flood of papers. The complicated review procedure adopted to improve the quality of papers and reduce printing expense has resulted in an early "deadline" for authors which, it is frequently claimed, has militated against "timeliness" of some papers.

Suppose, for discussion only, that the Professional Division Conferences were to be made the principal theater for the initial presentation of all highly technical papers on specific subjects. Suppose that such papers were prepared only in multilithographic form without other review than that of the Division Executive Committee (or a special committee for program of the Division Conference). Then suppose that, within a "page budget" prepared by the Meetings and Publications Committees, the members attending the Professional Division Conference voted by secret ballot which of the papers were of such permanent and high technical quality as to warrant re-presentation at a National Meeting *and* publication in either Transactions or MECHANICAL ENGINEERING. Would this not give us a relatively free forum at the two principal National Meetings?

Would not the reduction in the complexity of multiple simultaneous sessions at our National Meetings resulting from such suggestion lead to a wider, more catholic, interest on the part of our members in *all* phases of mechanical engineering? And would it not only stimulate attendance but heighten interest in our National Meetings—the principal authoritative source where the latest and most important engineering advances in our field are expounded? I commend these thoughts for serious consideration. I have no pride of authorship for they are distilled out of the many long discussions with deeply interested members at not only Division Conferences but at our four National Meetings. Some adaptations of them may open a way for our Society to travel in the near future.

Shortage of Engineers

Our profession is passing through a critical phase. Serving, as we do, the industries of our country, which are growing rapidly in order to produce the goods and services required for our increasing standard of living, for our rapidly increasing population, and for our national defense, we face many problems. These include the inadequate supply of competently trained junior engineers and an imbalance in the composition of our engineering staffs which stems from inevitably rapid promotions. Such problems, together with those of our high schools and colleges, have been the basic themes

1956—Then What?

Suggestions by retiring ASME President regarding visits to Sections and Student Sections, restudy of regions, meetings, conferences, manpower shortage, teachers, education, retention and development of younger members, and other problems confronting the Society

By Joseph W. Barker

Retiring President, The American Society of Mechanical Engineers

IT HAS been the custom in our Society for the retiring President to give an account of his stewardship and out of his experiences to make suggestions for consideration by the Society, its Council, and appropriate committees.

First, I want to thank the members of our Society for the privilege of serving as your President. It has been a rich and rewarding experience. Everywhere we have visited we have cemented old friendships and, more importantly, made so very many new friends. The gracious hospitality extended Mrs. Barker and me has been heartwarming and puts us eternally under obligations to those who so charmingly looked out for not only our needs but our pleasure. We express our gratitude.

Presidential Visits

At the same time, we express our regret that it has not been possible to visit more of our Sections, Student Branches, and Professional Division Conferences. The choices we were forced to make were not because we did not want to visit with those omitted, but simply arose from the exigencies of travel routing and time available.

Our Council has recognized these unfortunate limitations and has established a policy for scheduling future Presidential visits over a five-year period. Considering the program of Professional Division Conferences and their projected locations, it is anticipated that Sections and Branches may expect to have a Presidential visit on the average of once in five years. These visits will be supplemented in the off years by visits from the regional vice-presidents. Even this will not make it possible for each Section and Branch to be visited every year. We recognize full well that this is inadequate coverage, but even the eight vice-presidents plus the President cannot do more, particularly when the vast distances in our country are considered.

Also, without any disparagement of the activities of Section officers and program chairmen, it may be said that ASME members at large are not overly interested in hearing the President speak at Section meetings. Without any doubt, the inevitable irregularity caused in Section meeting dates to match into a Presidential travel schedule plan raises many problems for the local groups. When the Section members have become accustomed to having meetings scheduled for, say, the first Wednesday night in each month and suddenly the Presidential travel routing makes the third Monday night available, it is thoroughly understandable why attendance is low. So many Section officers apologized to me when only, say, 10 per cent of the Section membership attended the Presidential meeting visit. This situation is, however, inevitable since the Presidential travel schedule must be arranged in certain "tours," usually not longer than one month in length (because of monthly Executive Committee or Council meetings at Headquarters), and train and plane schedules are a controlling factor. In addition, these Presidential tours must be fitted into the schedule of Professional Division Conferences, Spring, Summer, and Fall National Meetings. I have puzzled many hours and many times trying to find some way out of these difficulties, but completely without success.

Our colleagues in the AIEE have abandoned Presidential visits to Sections, but certainly I would never recommend this course to our Society. Even if only the Section Executive Committee members meet with the President informally on his visit, it would still be worth the time and expense of the visit. In fact, such experiences during my year gave me more understanding feeling of the "grass roots" sentiments than did the formal speaking engagements. Yet I must confess that I missed the elation of meeting more of our members.

Generalizations are always dangerous, but my impression was that where our Sections were officered by younger members, the attendance and the enthusiasm averaged high. One such Section (a small one to be sure) turned out nearly 90 per cent of its enrolled members *and* their wives for dinner and the meeting! And the informal discussions went on for an hour after the

---

Presidential address delivered at the President's Luncheon, New York, N. Y., during the Annual Meeting, Nov. 25–30, 1956, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Retention of Student Members

Even supposing that we do find means of meeting the engineering shortages both in numbers and quality, we still have a tremendous problem within our Society in terms of retention of interest of our Student Members, as they graduate, to keep them as Associate Members.

I have been gratified to find in some (regrettably not in *all*) ASME Sections very effective activities aimed at arousing the interest of young engineers in the work and the social affairs of the Society. ASME is doing much, and is planning to do more, to interest the mechanical-engineering student in becoming a member of our profession and its Society. A glance at ASME's financial report (pages 64-66 in this issue) will indicate substantial support of Student Branches to help lay the groundwork for fuller participation after graduation.

But unless the Sections interest themselves in seeking out the newly graduated engineer and interesting him in Section activities, past experience demonstrates that we have better than a 70 per cent chance of losing him in the first five years. No engineering sales organization would be rated "good" that spent money in developing prospects and then proceeded to neglect them after the first sale.

Promotion to Associate Member

Upon graduation, Student Members are promoted automatically to Associate Members. At this time their names and addresses will be sent to the office of the appropriate Section. There will no longer be the excuse that the Section didn't know the employment of these young graduates in their area. There is every reason for the Section to follow up and insure that the new engineer is brought into the Section activities. The progressive Section, furthermore, will find committee or other work into which he can be integrated. (And I hope our Woman's Auxiliary Sections will seek out the wives of these new engineers. There is nothing so lonesome as a bride moved to a new locality. A welcoming call by an older engineer's wife and the offer of friendly contacts in our ASME Woman's Auxiliary would do much to increase the interest of both the engineer and his wife in our Society.)

Technical Development of Associate Members

Our national Junior Committee is working hard on the problem of providing programs of interest and value to our younger members. Section program committees can well bear in mind that the technical development of our Associate Members is a most important phase of Section activity. Just as an engineering school plans a curriculum geared to the intellectual level of the various classes—Freshman through Senior—so should our Section program committees plan meetings geared to the various constituencies within the Section. The younger members will want technical papers of interest at their level of professional competence, while the older engineers will want more generalized presentations. Completely separate meetings are not the answer, for one of the main advantages of membership to the young engineer is the opportunity to meet, and to work with and to know older engineers in Section activities. This poses a difficult but not insuperable programming problem which deserves the best attention of all our Section members.

On these two subjects—retention of our young Associate Members in ASME (and their wives in our Woman's Auxiliary) and programming—every individual member of ASME can do yeoman service. And in doing such service *for* our Society, he gets more *from* the Society. He helps to form our Society activities as he—Mr. Grass Roots Member—wishes them to be, not as some retiring President thinks they ought to be. This is true democracy, and more active participation by *every* member in *all* the work of ASME will lead our Society forward to ever greater heights of achievement.

Engineering Center

To touch on two additional points of interest to members—first, decision has been reached as to the place for an adequate center for the engineering profession by five societies (ASCE, AIME, ASME, AIEE, and AIChE), which agreed to work the problem out together. In October, 1955, a task committee of fifteen was organized and provided with funds to engage consultants. This committee, on June 27, 1956, recommended that the center be located in New York. The boards of the five societies have now approved this recommendation. The committee made additional recommendations as to means of carrying out the report which involved United Engineering Trustees, Inc., the custodian of the present building. AIChE is joining UET. Studies of a proposed new building are under way and a fund-raising campaign will be started in the near future.

Federal Income Tax

Second, during the past year a question was raised by the District Director of Internal Revenue as to the Society's liability for federal income tax on its income from advertising in its publications. The question involved is whether or not the Society's publishing activities constitute an "unrelated business" within the meaning of the tax laws.

At the general business meeting during the 1956 Semi-Annual Meeting in Cleveland I reported that we had authorized our attorneys to do everything necessary to obtain a favorable ruling in Washington. There have been no developments since that time, but our attorneys are following the matter closely. There has, so far, been no claim of any specific amount of tax liability, but the decision on this matter will affect several past years.

I understand that a number of other societies have recently met the same claim, and that their cases, along with ours, have been referred to Washington for decision in the office of the Commissioner of Internal Revenue.

Conclusion

Finally, I want to repeat that I have thoroughly enjoyed every minute of this busy year in Society activities. Every one of you has been most kind, thoughtful, and friendly. I hope you will accept my thanks. I know you will give the same support and encouragement to William F. Ryan, incoming President of ASME, who has already begun his plans to make next year an even greater year in ASME history.

of the many addresses that I have given this year.

While an increase in the numbers of engineering graduates is important if we are to make a start on decreasing the shortage of engineers, the improvement in "quality" of engineering training is of ever greater importance. As industry moves to greater degrees of automation, to offset higher wage and raw-materials costs, the increased complexity of engineering designs, maintenance, and operation problems will require an ever higher quality of trained engineers. Thus the strain on our engineering schools is more than doubled. They must educate increased numbers of students *and* improve the quality and depth of engineering instruction.

Status of Teachers

Our schools will be strained for both physical plant and personnel. Certainly increased physical plant must be provided in *all* our schools to handle the rapidly increasing student population arising from the phenomenal continuing increases in birth rate which have occurred since World War II. Such physical plant facilities can be built, the only requirement being money. But the provision of adequate numbers of thoroughly competent and dedicated teachers can *not* be accomplished by *money* alone, important as teacher salary improvement is. To attract highly competent young people into the teaching profession, from primary grades through university postgraduate years, we must make the post of "teacher" one of the most respected positions in our communities.

But in my opinion this will not occur in our public-school system as long as we permit the retention of the present type of promotion and salary plans. These are based not upon the merit system of evaluating the "quality and inspiration of the teaching duties" performed by the individual but principally upon the number of years of teaching in that particular school system and upon the number of credit points earned toward a graduate degree in education (often with primary emphasis upon courses in "how to teach," not in "what to teach"). We need an aroused public opinion which will examine critically but sympathetically the public-school system through which our children are educated. After all, our children are exposed for more hours per day to the personality, philosophy, and inspiration (or lack of it) of the teacher than they are to us as parents in the home or to our religious leaders in our churches.

Secondary School Education

But in addition to our responsibilities as citizens and parents, we, as engineers, have additional responsibility with respect to secondary education. Here in the junior and senior high schools is—or maybe I had better say should be—laid that foundation in mathematics, physics, and chemistry which underlies all engineering education.

Here also the young students receive vocational guidance which may determine their future careers. If these foundation courses are poorly and uninspiringly taught and if vocational guidance is misleading as to opportunities ahead, we will not secure the rational proportion of our most able-minded students as prospective entrants into engineering schools and as prospective members of our profession. Our profession is *not* entitled to *all* the most able students, but we and our pure-science colleagues are entitled to those who show clear abilities and interests in math, physics, and chemistry in high school. And if we are not only to meet the engineering shortages in numbers but are also to improve the quality and depth of engineering instruction, we have a clear responsibility to see that the entering freshmen—our raw material—are of high quality both in mental ability and in fundamental training.

Engineering and Science Education

But granted that, in spite of the many obstacles, we do succeed in attracting both increased numbers and higher-quality engineering freshmen, then we as engineers and scientists have even deeper responsibilities toward our engineering and science schools. As I have previously said, they must educate increased numbers of students *and* improve the quality and depth of instruction. If this is to be achieved, we cannot afford to permit the continued raiding of our most competent engineering and science faculties by industry—no matter how serious industry's temporary needs may be. Highly qualified and dedicated engineering and science teachers are rare, and hiring them away from education to meet industry's emergency needs is surely "killing the geese that lay golden eggs."

But to this there is a corollary of immense importance. It would be unfair to our engineering teachers to ban *all* offers from industry, since even educational salaries are controlled to a greater or lesser extent by the law of supply and demand.

Actually what we need to do is to bring individual engineering and science teaching salaries to levels reasonably comparable with industrial salaries for those men of equivalent capabilities and attainments. Then there would be no need for a ban on "raiding," for raiding could go on with equal vigor on both sides—and probably with advantages to both industry and education.

However, to do this, our engineering and science schools must have real and substantial financial help and this in addition to what will be needed to provide the increased physical plant.

Support of Industry

Industry spends, and very properly so, many millions of dollars annually in support of applied research and development aimed at the possibility of capturing the lead for tomorrow's new products. Why should not industry generally follow the lead of some enlightened companies and support also the engineering and science schools which—not possibly but actually—are producing tomorrow's engineers and scientists? Even though everyone knows that I am connected with an organization dedicated to the support of research, I can state with firm conviction and clear conscience that such support of engineering and science education is less of a gamble with stockholders' money than is the support of research within the organization.

Such educational support is also a particularly sound investment, since educational grants are tax-deductible, of course, within the 5 per cent allowable in federal corporate income taxes, and you start off with odds of 100 to 48 or better than 2 to 1, since every dollar of educational grant costs the company stockholders only 48 cents net after taxes!

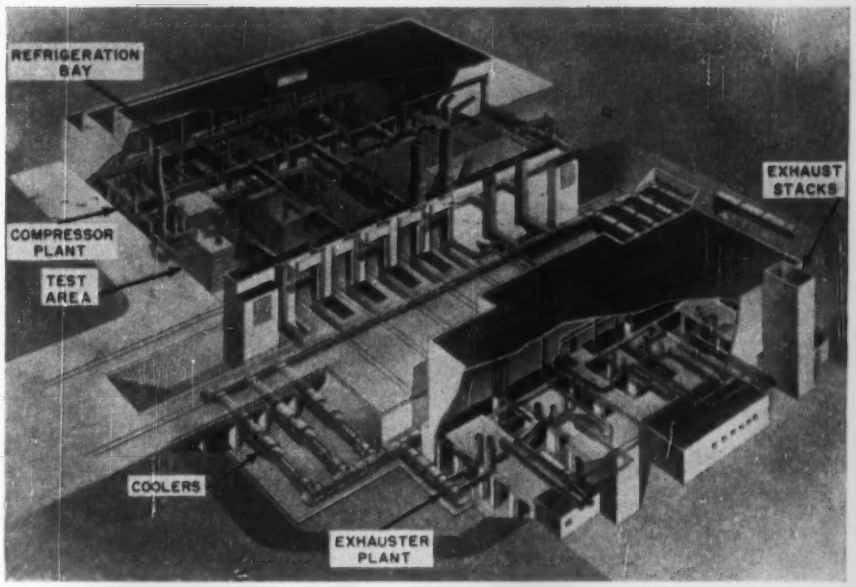


Fig. 2 The Engine Test Facility for the development and evaluation-testing of aeronautical air-breathing engines under simulated flight conditions

The Engine Test Facility

The Plant. The Engine Test Facility, Fig. 2, is for development and evaluation testing of aeronautical air-breathing engines under simulated flight conditions. To produce such conditions air is brought in from the atmosphere, compressed to the desired pressure, dehumidified, cooled or heated to the desired temperature, and directed to the inlet of the engine in the test cells. For certain tests the air is ducted directly to the engine inlet; in others, the air is accelerated to the proper velocity (Mach number) and directed against the engine inlet in a free-jet condition. Ambient altitude conditions (static pressure) are maintained at the engine exit by means of exhauster compressors, which pump the air back to atmosphere.

A total of 20,000 hp is used in the airside plant; 40,000 hp in the exhauster plant; and 2600 tons of refrigeration in the conditioning system.

While undergoing tests, the engines are mounted in any of three 12-ft-diam test cells, two of which are shown in Fig. 3, or in an open test area that can accommodate four additional engine setups. A 40,000-hp absorption dynamometer is being installed in one test cell for turboprop testing.

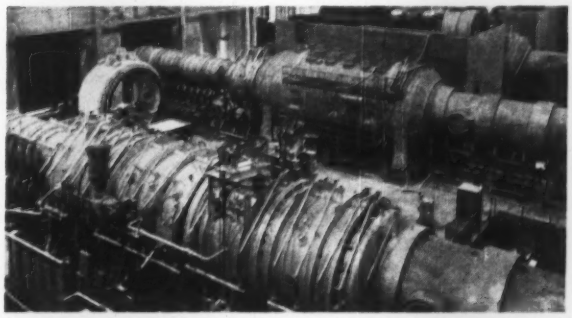


Fig. 3 Test cells T-4, ramjet (foreground) and T-1, turbojet, of the Engine Test Facility

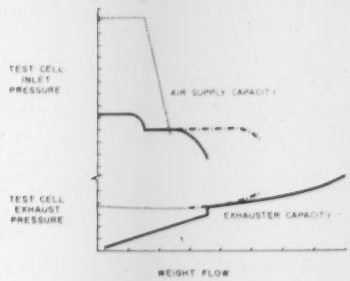


Fig. 4 Plant performance, Engine Test Facility

ETF Performance. The performance of the ETF as taken from actual calibration results is shown in Fig. 4. Corresponding lines, solid, dashed, or dash-dot, represent compatible compressor and exhauster configurations. A temperature range from −120 F to 650 F is available for this operation. Thus ETF test work can be conducted across a broad range of simulated flight conditions from sea level to approximately 80,000 ft and speeds from 0 to M = 3.0. This is sufficient testing capacity for most turbojet and turboprop engines now in operation, and for some ramjets. Larger engines can be tested in the Ram-Jet Addition which will be discussed later.

ETF Operation. The Engine Test Facility has been in operation for over two years. In this period over 15 engine tests have been conducted for five engine and airframe manufacturers. Currently five engines are

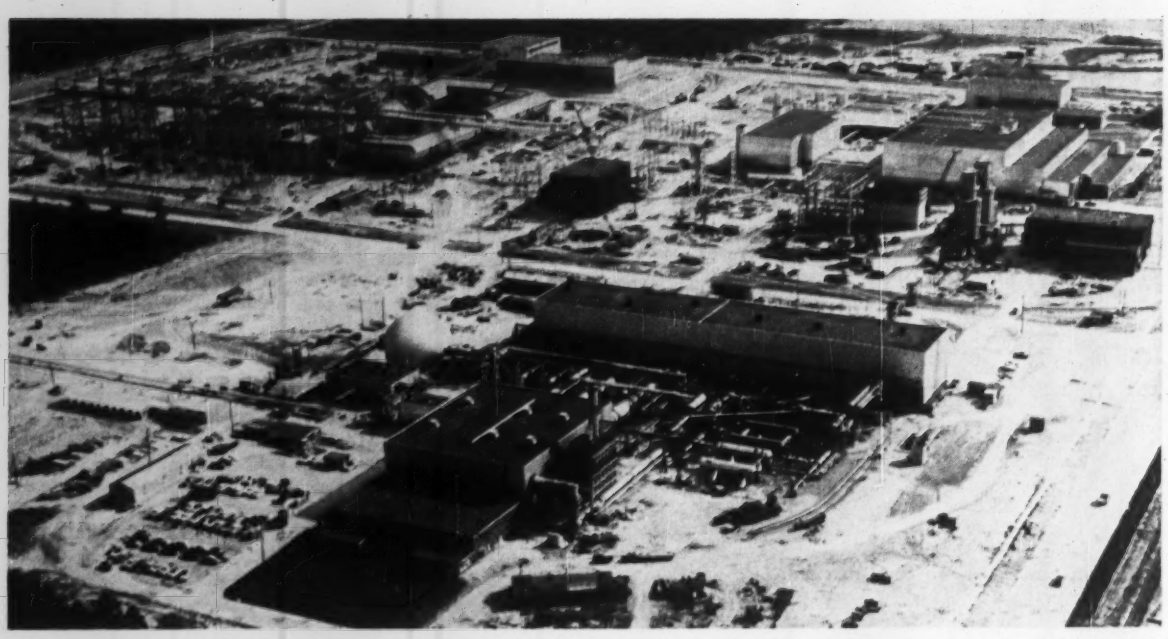


Fig. 1 Aerial photograph of the AEDC technical facilities. The Gas Dynamics Facility is in the center foreground; the Engine Test Facility and Ram-Jet Addition, upper right; and the Propulsion Wind Tunnel, upper left.

Arnold Engineering Development Center

Unique features of the propulsion facilities at the AEDC, available to industry for research and development testing

By John M. Wild

Director of Engineering, ARO, Inc., Tullahoma, Tenn.[1]

THE Arnold Engineering Development Center (AEDC) at Tullahoma, Tenn., is one of the major centers of the Air Research and Development Command of the United States Air Force. The law[2] under which the facilities of this Center, and others of the Unitary Wind Tunnel Plan were authorized provides that "the facilities shall be available primarily to industry for testing experimental models in connection with the development of aircraft and missiles."

Three major technical facilities, Fig. 1, are under construction at the AEDC. Major segments of each facility are already in operation. The Engine Test Facility (ETF) with its Ram-Jet Addition (RJA) is primarily for the development of air-breathing engines, their components, and accessories, although, as described later, this facility may also be used in the solution of propulsion-unit installation problems. The Propulsion Wind Tunnel (PWT) is primarily for the testing of full-scale engine installations with hot engines, although it may also be used for aerodynamic tests where large models or simulated altitude conditions are desired. The Gas Dynamics Facility (GDF) is a battery of supersonic and hypersonic wind tunnels covering a wide range of Mach and Reynolds numbers and was designed primarily for aerodynamic tests. Such tests include inlet testing, and a substantial amount of the work done in the GDF has been in this field.

This paper proposes to discuss in more detail those facilities of the AEDC whose primary function is to serve industry in the field of propulsion, namely, the Engine Test Facility, Ram-Jet Addition, and the Propulsion Wind Tunnel.

[1] Contract operator, AEDC.

[2] Public Law 415, 81st Congress, October 27, 1949.

Contributed by the Aviation Division and presented at the Semi-Annual Meeting, Cleveland, Ohio, June 17–21, 1956 of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Condensed from ASME Paper No. 56—SA-71.

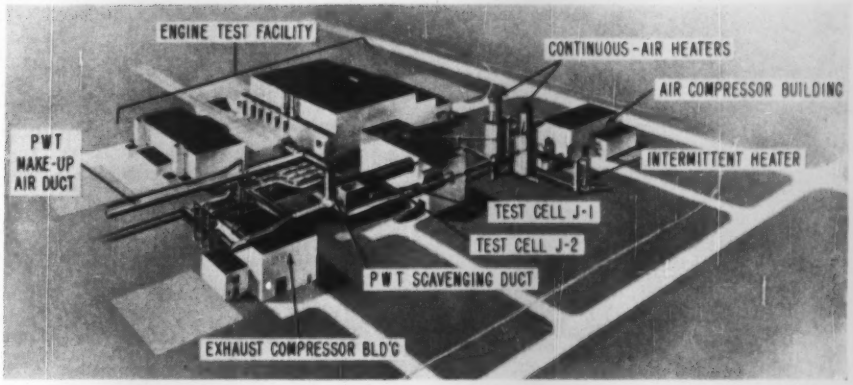


Fig. 6 The Ram-Jet Addition now nearing completion will use and augment both the air supply and exhauster capacity of the Engine Test Facility

RJA Operation. Shake-down operations on compressors are already under way in the RJA; the 800 F heaters are in operation in support of ETF tests. The first test cell is expected to be in operation early in 1957.

A unique feature of the RJA is its ability to handle trajectory testing. Most of the steady-state facilities, such as the ETF, are capable of handling engine transients such as throttle bursts or altitude starting, but trajectory testing requires changing plant conditions to simulate varying altitude (pressure and temperature), Mach number, and angle of attack. The RJA has been designed to accomplish this, and will be the only facility in the country to have this capability. This is clearly a significant step in the direction of producing more realistic flight phenomena in ground-testing facilities.

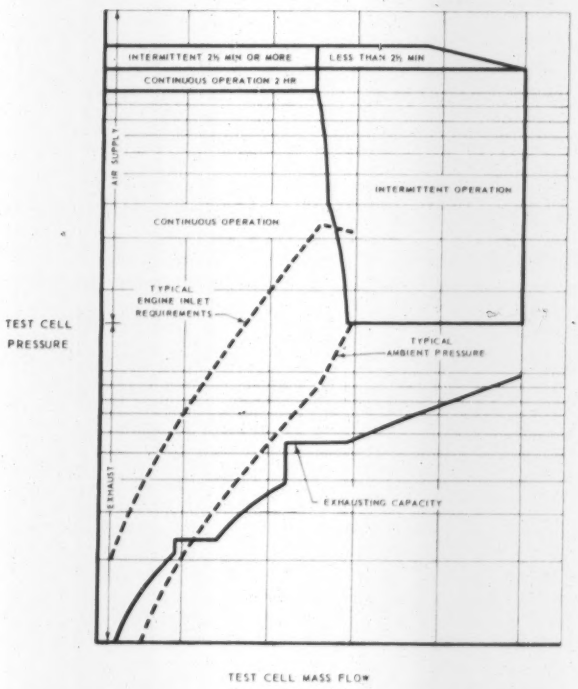


Fig. 7 Estimated performance of the combined ETF-RJA

The Propulsion Wind Tunnel

The Plant. The Propulsion Wind Tunnel is for determining the combined aerodynamic and propulsive effects of full-scale propulsion-unit installations as actually installed in the airframe over a wide range of simulated-flight conditions. It may also be used for a wide variety of aerodynamic tests where large or even full-scale models are desired or where ambient-flight conditions of pressure, temperature, and Mach number are required.

The PWT, Fig. 8, consists of two continuous-flow closed circuits, one transonic and one supersonic. Each has a 16-ft-sq test section 40 ft long; each has a two-dimensional flexible wall nozzle upstream of the test section. The supersonic circuit has a second throat to increase its performance. Both test sections may be equipped with transonic walls with supplemental plenum-evacuation equipment for boundary-layer removal and wave cancellation.

Although each circuit has its own axial-flow compressor, 3 stages for the transonic circuit and 18 stages for the supersonic circuit, there is but a single motor system. The total main-drive horsepower is 216,000 which can be applied in total to either compressor separately or to both compressors simultaneously, half power to each.

To remove the products of combustion from the closed-circuit tunnels and to provide pressure-level control, scavenging and make-up airlines are connected to the ETF-RJA. The total air-supply and exhauster capacity of that facility may be used to support the PWT operation.

Temperature control is obtained through the use of air-water heat exchangers, one in the transonic circuit and two in the supersonic circuit.

PWT Performance. The estimated performance of both circuits of the PWT is shown in Fig. 9. The Mach-number range for the transonic circuit is from 0 to 1.6; for the supersonic circuit from 1.5 to 4.9. The shaded regions denote areas where the altitude temperature cannot be fully simulated; in the lower left the temperature is too hot by amounts indicated by Δ_{t_0}, and in the upper right the temperature is too cold. When simulated temperatures are not required, both tunnels may be operated at stagnation temperatures as low as 100 F throughout the entire Mach-number range.

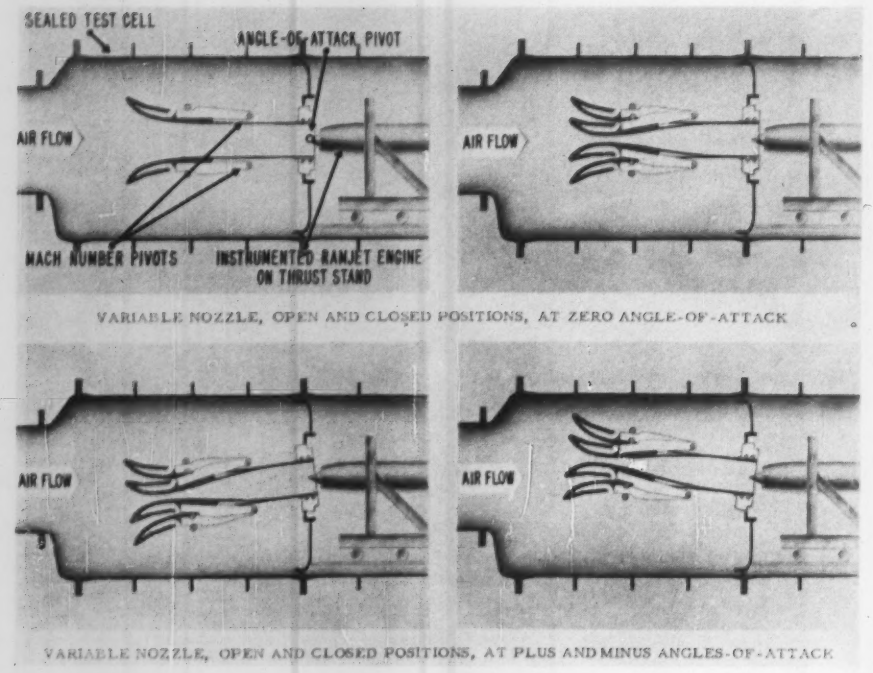

SEALED TEST CELL
ANGLE-OF-ATTACK PIVOT
AIR FLOW
MACH NUMBER PIVOTS
INSTRUMENTED RAMJET ENGINE ON THRUST STAND
AIR FLOW
VARIABLE NOZZLE, OPEN AND CLOSED POSITIONS, AT ZERO ANGLE-OF-ATTACK
AIR FLOW
AIR FLOW
VARIABLE NOZZLE, OPEN AND CLOSED POSITIONS, AT PLUS AND MINUS ANGLES-OF-ATTACK

Fig. 5 Operating principle of variable Mach number, variable angle-of-attack free-jet nozzle, Engine Test Facility

installed in the facility, and actual engine tests are accomplished at a rate of 200+ hr per mo. On a 24-hr-per-day basis, that is, including aerodynamic tests and plant-maintenance work, the plant is operated between 70 to 80 per cent of the time. Test data are produced during 75 to 85 per cent of this time.

Tests have included the conventional altitude evaluation tests of both engines and components, and programs involving nacelle configurations, inlet-distortion tests, control-system development under engine transients, ejector studies, and air-bleed operation. As many as 600 pickup instruments have been installed on a single setup including both steady-state and transient instrumentation.

The Facility has several unique features that are worthy of special mention. One very effective device for speeding up the production of free-jet test data is the semiflexible nozzle that permits a rapid change in both Mach number and angle of attack, Fig. 5. A nozzle of this type, 48 in. × 54 in., has been designed for the RJA and will permit trajectory testing with Mach-number variations of 0.5 per sec and angle-of-attack changes of 15 deg per sec. A 26-in. × 26-in. model of this nozzle was built to check its aerodynamic characteristics. This model nozzle was so successful that it has remained in the test cell for over 18 months and is currently being used in free-jet testing of ramjets.

In free-jet tests, approximately half of the flow passes through the engine and the other half outside of the inlet. A remote-viewing shadowgraph system is used to insure correct shock positioning for accurate flight simulation.

The Engine Test Facility, and each of the other two major facilities, are equipped with a high-speed on-line automatic-data-reduction computer, the use of which permits reduced data to be placed in the hands of engineers conducting or monitoring the tests in time to influence the course of the tests. In-service reliability of the computer has been over 95 per cent; scheduled maintenance takes about 10 to 12 per cent of the over-all running time.

The Ram-Jet Addition

The Plant. It was recognized early that the capabilities of the ETF would fall short of some of the larger engine requirements not long after the facility came into operation. To provide greater capacity, an addition was designed, and is now nearing completion, to use and augment both the air-supply and exhauster capacity of the ETF, Fig. 6.

The RJA adds 53,500 hp to the airside equipment; 61,000 hp to the exhauster side; and two additional test cells, a 16-ft-diam cell and a 20-ft-diam cell, both of which are to be equipped with the semiflexible free-jet nozzles described previously.

Additional air can be provided on an intermittent basis from the Gas Dynamics Facility's high-pressure storage reservoir.

ETF-RJA Combined Performance. The estimated performance of the combined ETF-RJA is shown in Fig. 7, which defines the region of continuous and of intermittent flow. The temperature range corresponding to this performance is from −120 F to 800 F, with a 1200 F booster heater planned for the near future. This permits flight conditions to be simulated up to M = 4 and altitudes up to 90,000 ft. Points from a typical engine-operating envelope are shown by the dashed lines in Fig. 7.

Metallurgical Yield-Stress Observation

Stressing metallograph used to study mechanism of failure of grain structure of SAE 1055 steel

By Joseph William Jacobson, Assoc. Mem. ASME

University of Texas, Austin, Texas

It has been said that photography is the daughter of science, and now through the use of metallography the study of the mechanism of failure within the grain structure of a material can yield many interesting results. Through research in this line it is hoped that a better understanding can be had of failure in metals which are used daily.

The research was done with a stressing metallograph designed for this purpose. The same field that was chosen at no-load was followed through the loading until failure occurred without unloading the specimen.

The results are presented in the form of micrographs, thus giving a visible reproduction of the failure of a material under load.

Apparatus

In order to study better the mechanism of failure within the grain structure of a material, the design of the apparatus shown in Fig. 1, called a stressing metallograph, was necessary. This apparatus allows the field chosen to be kept in focus at any load by the use of a vertical and a horizontal traverse. The controls for this are seen at the top and side of the apparatus. On the right is a strain-gage indicator that registers the strain in microinches per inch caused by some imposed load.

The pump and the head of the loading jack can be seen in the center of the illustration. The globe valve was put on in order to hold the load constant while a micrograph is made. The front view of the camera and bellows extension are shown with the latter swung down in place behind the microscope in order to make the micrographs. This also allows the material to be observed at all times and not just at the intervals at which the micrographs are made.

Specimen

The material used for this research was an SAE 1055 steel which has a calculated yield stress of 72,000 psi and an ultimate yield strength of 97,000 psi. Similar runs, with good results, also were made on pure iron and SAE 1080 steel.

The specimen was cut from bar stock to a length of 1.0 in. and a width of approximately 0.05 in. The specimen was mounted in bakelite and polished according to standard metallurgical procedure. The bar stock was deliberately necked down in the center to force the failure to be within the general area of the microscope. The specimen was etched for 12 sec in a 5 per cent nital solution.

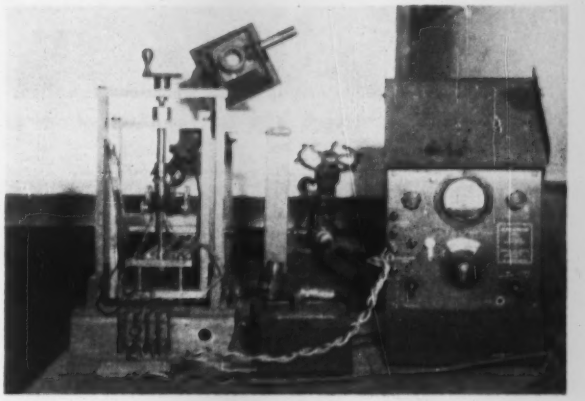


Fig. 1 View showing stressing metallograph and equipment used in tests of grain-structure failure

Micrographs

The micrographs are shown in Figs. 2 through 6. Fig. 7 gives a graphic relationship of the photomicrographs with respect to an idealized stress-strain curve. The no-load micrograph of the 1055 steel specimen is shown in Fig. 2. Medium-high carbon steel was chosen for its somewhat even distribution of the pearlite (dark areas) and the ferrite (light areas). The loading in the micrograph is horizontal to the page (as will be the case in all subsequent micrographs) and the magnification is ×1500.

In the second micrograph, Fig. 3, the stress on the specimen is at 44,000 psi. This micrograph is at the metallurgical yield stress of the material, and the first slip planes can be seen in the upper area proceeding between two points of pearlite through the ferrite grain. The other slip planes can be seen starting from the grain boundaries or sharp protrusions on the pearlite and proceeding into the ferritic grains. These sharp protrusions will be referred to as metallurgical yield-stress raisers, as a scratch on the surface of a material can cause a stress concentration. They have the same effect within the grain structure of the material.

The micrograph in Fig. 4 is at the calculated yield stress of the material, 72,000 psi. There are slip planes in all parts of this micrograph, and it can now be observed that some of the slip planes have become small

Awarded "Old Guard Prize" from among twelve Regional Student Conference winners, at the Semi-Annual Meeting, Cleveland, Ohio, June 17–21, 1956, of The American Society of Mechanical Engineers.

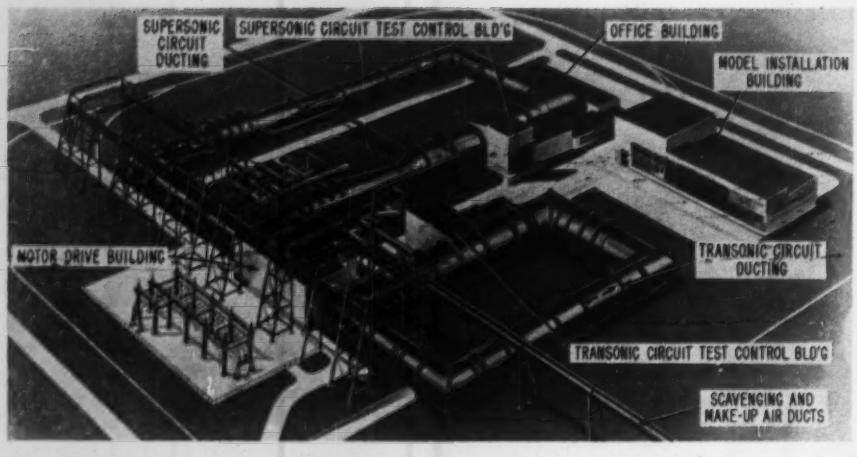


Fig. 8 The Propulsion Wind Tunnel for determining the combined aerodynamic and propulsive effects of full-scale propulsion-unit installations as actually installed in the airframe over a wide range of simulated flight conditions

PWT Operation. The transonic circuit is essentially complete and is in the shake-down stage; the shell has been pressure and leak-checked and the compressor has been turned over by the main motors. The first development test in this circuit is scheduled for February, 1957.

The supersonic circuit is under construction at the present time. It is expected to be in test operation early in 1959.

To obtain maximum utilization of the plant, both circuits are equipped with removable and interchangeable test sections. Each such test section has been designed to accept a wide variety of support and mounting systems. Thus extensive and complex test setups can be made and checked out without holding up the operation of the tunnel.

The problem of testing very large models or installations, particularly in the transonic range, was perhaps the most difficult one that faced the tunnel designers. Tests in the early transonic-wall tunnels were limited to models not larger than about $^1/_2$ of 1-per-cent blockage area. Such a limitation would obviously render the transonic circuit completely inadequate to carry out its mission of testing full-scale installations. Intensive research carried out by the AEDC in the 1-ft Transonic Model Tunnel and by others has led to the development of perforated walls that have greatly alleviated the earlier limitations.

In the critical transonic range the PWT can handle test articles for aerodynamic tests of up to 2-per-cent blockage; for propulsion testing of up to 5 per cent and, if considered as a free-jet nozzle for inlet-engine tests, up to as much as 50 per cent. For Mach numbers beyond the transonic range these values will be somewhat higher.

The appended references give more details on these facilities and on the method for securing test time.

Bibliography

1 "AEDC Bluebook," Arnold Engineering Development Center, Tullahoma, Tenn., November, 1954.

2 "Testing Services of the Engine Test Facility, Arnold Engineering Development Center," by ETF Staff, ARO, Inc., AEDC-TN-53-18, June, 1955.

3 "Description of the Transonic Model Tunnel—Arnold Engineering Development Center," by Hugh E. Gardenier, AEDC-TR-54-70, May, 1955.

4 "On-Line Automatic Data Reduction, Tunnel E-1, Gas Dynamics Facility," by C. L. Hall and R. E. Klautsch, AEDC-TN-56-4, April, 1956.

5 "Flow Establishment and Wall Interference in Transonic Wind Tunnels," by B. H. Goethert, AEDC-TR-54-44, June, 1954.

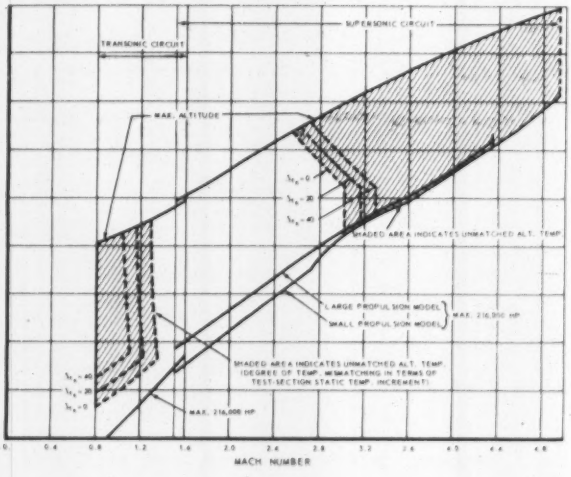

TRANSONIC CIRCUIT
SUPERSONIC CIRCUIT
MAX. ALTITUDE
NACA STANDARD ALTITUDE
SHADED AREA INDICATES UNMATCHED ALT. TEMP.
LARGE PROPULSION MODEL
SMALL PROPULSION MODEL
MAX. 216,000 HP
SHADED AREA INDICATES UNMATCHED ALT. TEMP. (DEGREE OF TEMP. MISMATCHING IN TERMS OF TEST-SECTION STATIC TEMP. INCREMENT)
MACH NUMBER

Fig. 9 Facility performance, Propulsion Wind Tunnel. The shaded portions denote areas where the altitude temperature cannot be fully simulated; in the lower left, the temperature is too hot by amounts indicated by Δt_s, and in the upper right, the temperature is too cold.

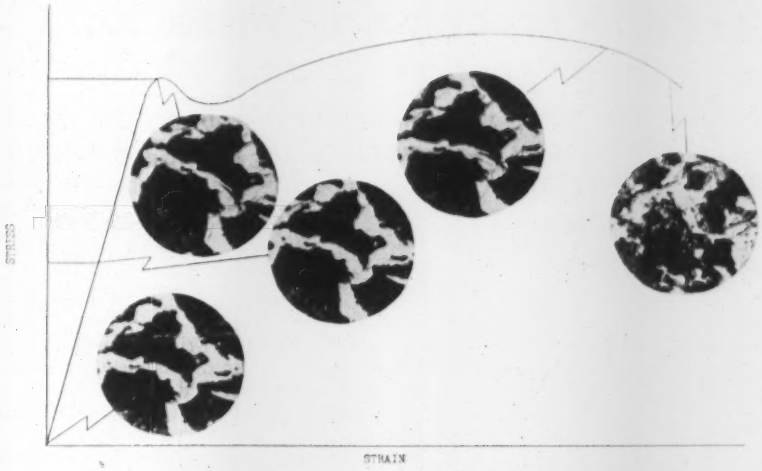


Fig. 7 Stress-strain relationship for 1055 steel and the corresponding grain structure. Photomicrographs ×1500 nital etch.

load then the grain beside it and fail to pull to one side. As the micrographs were timed for 1 min, it is quite probable that this is what occurred. Much more elongation can be seen in the ferritic grains than in the pearlitic grains. This is a good illustration as to why high-carbon steels are stronger than those of low-carbon content.

Summary

It has been observed that there is a definite elongation of the material before the yield point is reached and that it is also below the proportional limit of the material. This point is called the metallurgical yield point, and the load causing this elongation is referred to as the metallurgical yield stress. It may be defined as that stress calculated by assuming a uniform stress distribution where the first slip planes can be seen or are observed at high magnification.

A metallurgical yield point cannot be detected by usual testing procedures as instruments which measure strain are not capable of noting small deformations that can be observed under high magnification.

Conclusions

From close observation of the specimen tested the following observations were made:

1 There is a definite elongation of the material before the yield point is reached; this point is designated as the metallurgical yield point.

2 Failure occurs initially in ferritic grains.

3 Slip planes are caused by protrusions or sharp points on the pearlitic grains. These are referred to as metallurgical yield-stress raisers.

4 The slip planes caused by the protrusions start from the grain boundaries and proceed into and across the ferritic grains.

5 The fractures align themselves with the most predominant set of slip planes.

6 Near the zone of failure considerably more elongation can be observed in the ferritic grains than in the pearlitic grains.

Future. With the redesign and improvements of the stressing metallograph it will be possible to take high-speed moving pictures of the failure in a material. This will enable a continuous study of the failure within the grain structure of a material.

Titanium Mill Fabrication

THREE major steps in improved mill fabrication of titanium were highlighted by Lee S. Busch, Director of Research of Mallory-Sharon Titanium Corporation of Niles, Ohio, in a special lecture on forging, rolling, and mill fabrication at the second annual titanium program of the New York University College of Engineering, September 10–14, 1956.

Producers now have a much better understanding of the requirements of processes and equipment for titanium production, Mr. Busch said. One result of this has been the addition of the MST 6Al-4V alloy to the list of available sheet materials. This is a high-strength alloy with excellent elevated-temperature properties.

A second major step described by Mr. Busch consists of blooming ingots directly to sheet bar or forging bar stock. This eliminates intermediate conditioning operations and leads to improved quality.

A third improvement is in vacuum-annealing techniques, which have been developed to accomplish adequate hydrogen removal and also help improve mechanical properties. Mallory-Sharon has recently put in operation the largest vacuum-annealing furnace in the United States, which is specially designed for close control and efficient handling.

Advances such as these, Mr. Busch said, are helping titanium make a spectacular rise in importance. Mallory-Sharon is currently engaged on a major expansion program which will double present capacity by 1957. This will serve growing demand for both military and civilian applications of the metal.

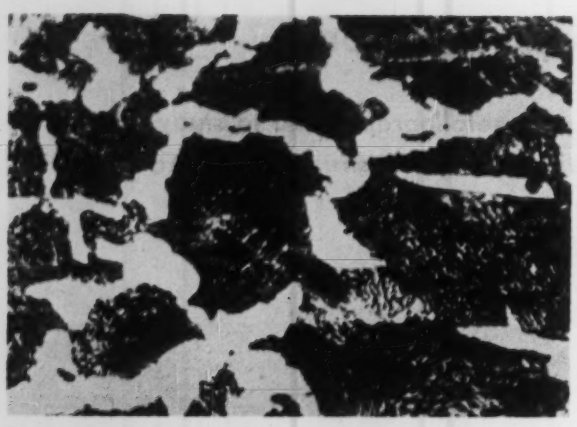


Fig. 2 No-load micrograph showing constituents of pearlite and ferrite; ×1500

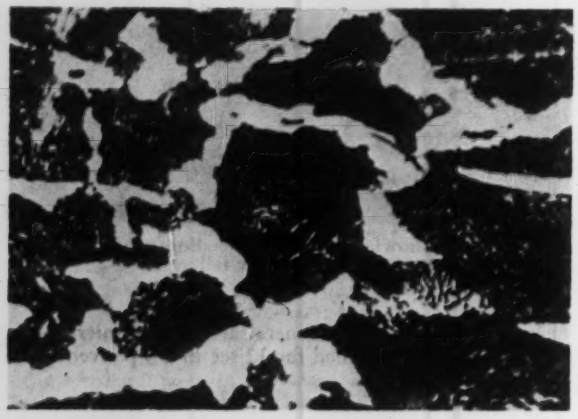


Fig. 3 Micrograph at the metallurgical yield stress 44,000 psi; loading is vertical

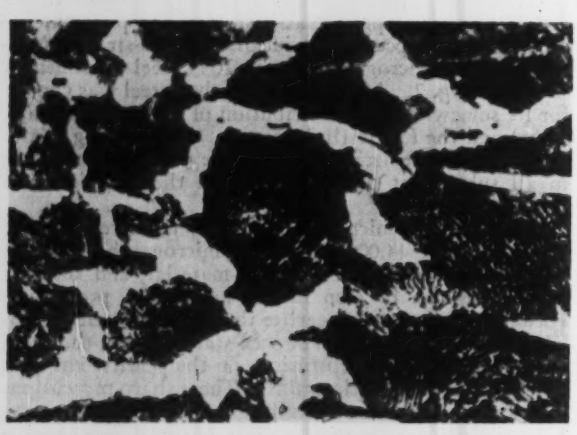


Fig. 4 Micrograph taken at yield stress of 72,000 psi

fractures that were at the last load nothing but beginning slip planes. These slip planes appear in the metal very rapidly; at one instant there is a clear field of ferrite, and in the next there has been a slip that proceeds into

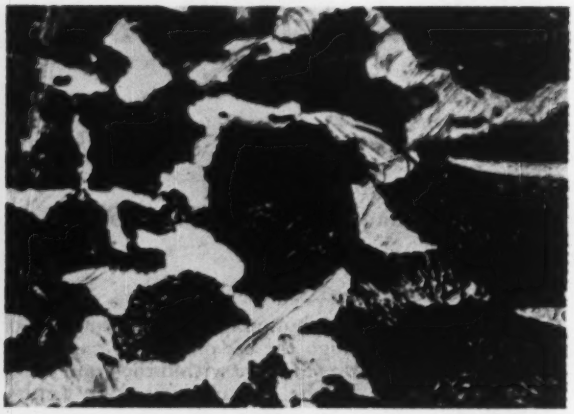


Fig. 5 Micrograph at the ultimate tensile stress of the material—101,000 psi

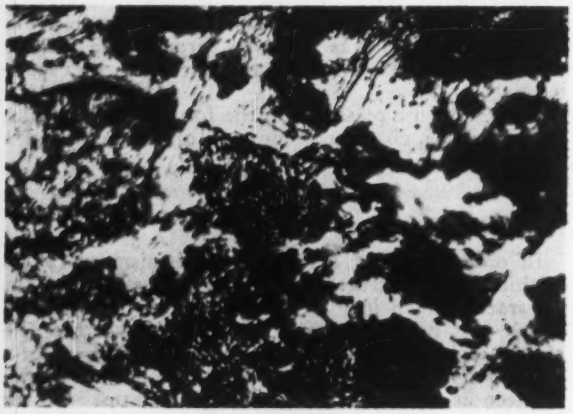


Fig. 6 Same as Fig. 5, but shown just before failure—100,000 psi. Note elongation in ferritic grains.

and sometimes across the grain altogether. Because the pearlite is the harder material, it did not exhibit any tendency to slip at this load.

Fig. 5 was made at 101,000 psi, and it can be observed that at this higher load there is also some evidence of slip in the pearlitic structure. The material at this load is at its ultimate tensile strength. Theory is borne out in this micrograph as the slip planes can be seen to lie at an angle, thus showing that a ductile material fails in shear and not in tension. If the material had failed in tension the slip planes would be perpendicular to the load. The difference in angles of slip planes in corresponding grains is due to the loading of one grain upon another, and the grains most favorably aligned with the granular loading have the largest number of slip planes. The fractures have now aligned themselves with the most predominant set of slip planes.

The last micrograph, Fig. 6, is at 100,000 psi. As the material starts to fail, it comes to pieces while it elongates. The original field is almost indistinguishable, for at a magnification of ×1500 a slight movement is considerable even within the grains. The nonfocus of the micrograph in spots is due to the fact that the material is ductile and, as it elongates, one grain may take more

In addition, a plant engineer has heavy responsibilities in seeing that the essential services of power, light, heat, steam, water, gas, and refrigeration are continuously available to keep the plant operating without interruption.

Maintenance Engineering

Mechanical engineers who select this type of work protect production by foreseeing and forestalling machine stoppage and failures. This activity is particularly important in rubber manufacturing because of the highly specialized machinery. Effective preventive maintenance results from use of maintenance supervisors trained in engineering.

Materials Handling and Plant Layout

These activities have much to do with the over-all cost of operating a plant. A mechanical-engineering approach to handling and layout problems minimizes in-process inventory to a point where there is least investment in materials being processed—a vital cost factor in any large industry.

Production Supervision

If directing the activities of others is a personal preference, production supervision provides an open field for mechanical engineers in this industry which depends so much on using specialized mechanical equipment. The rubber industry provides many opportunities for mechanical engineers in production supervision to advance toward higher management positions.

Packaging Design

A mechanical engineer who possesses artistic talent can find interesting and profitable employment as a packaging engineer or in design capacities where product appearance is critical. Getting word about the merits of a functional product to the public can be performed excellently by an articulate mechanical engineer who applies himself in advertising and sales promotion.

Purchasing, Research, and Power

Purchasing engineers have specific importance and responsibilities through their ability to analyze and evaluate materials and machines offered for sale to the industry. Research departments of rubber-products manufacturers use all types of engineers in many and varied activities. Steam-power heating and ventilating engineers also find opportunity for complete utilization of their specialized training.

These are but a few places where mechanical engineers are employed in the rubber industry. There are many other opportunities to suit very nearly every personal preference and aptitude.

The Petroleum Industry[2]

In the oil business, the mechanical engineer begins as a junior engineer in one of the branches. As he progresses in his development, he will normally receive experience in more than one branch. He may elect to become a specialist in the application of a phase of engineering. Or he may progress through to management, reaching levels dependent on his ability, temperament, and personal wishes and drive. Working as a mechanical engineer in the petroleum industry will stimulate all the study, thinking, and planning that the technically trained mind demands.

Mechanical engineers may be assigned to support any of the functions in the petroleum business. Their duties within these functions may be broadly classified into one of the following: (1) design engineering, (2) maintenance engineering, or (3) management.

Design

The mechanical engineer working on design may be solely an individual supporting a field operation, or he may be part of a staff of engineers. If he is working more or less on his own, he will find that his duties are more along the lines of a general practitioner. On the other hand, if he is working with a group, he will find that he may become a specialist. Generally, a mechanical engineer in the petroleum industry requires a knowledge of all facets of mechanical-engineering principles and, specifically, knowledge of the technical principles involved in the storage, heating and cooling, and transfer of liquids and gases, supplemented by a working knowledge of materials and structures.

An example of a group effort, utilizing specialists, is the design of a refinery unit. The work is the same whether accomplished within the operating company's own engineering department or whether a consulting engineering firm is retained to fulfill this function; consequently, the organization in either case will be substantially the same.

Although each plant is different, the engineering skills required for design are similar. These are essentially mechanical-engineering skills and include the following functions: (1) vessel design and conformance with applicable ASME Codes; (2) instrumentation and control design, usually requiring a separate department due to its complexity; (3) piping design, including line sizing based on flow characteristics of different fluids, and analysis for thermal stresses to locate properly pipe supports, loops, bends, and expansion joints; (4) equipment selection, including preparation of specifications for equipment normally supplied by equipment manufacturers, such as pumps, cooling equipment, heaters, and heat exchangers; and (5) project engineering, including co-ordination of the various design groups and general management of the project.

Maintenance

Maintenance of petroleum facilities is normally accomplished by the full-time employees of the operating company. Increased application of automation necessarily reduces the plant-operation expense and increases

[2] By M. R. Born, Chief Engineer, Petro-Chemical Division, Holmes & Narver, Inc., Los Angeles, Calif. Mem. ASME.

The Role of the Mechanical Engineer . . .

. . . in three fields—rubber, petroleum, and chemical —traditionally not considered his sphere of activity

The Rubber Industry[1]

Not many mechanical engineers realize that rubber and rubberlike substances are mechanical construction materials. In composition they are chemical materials, but that identity diminishes when they are embodied in finished products. The almost limitless range of their physical characteristics provides construction material for literally hundreds of thousands of mechanical applications, requiring professional activity of over 3000 mechanical engineers in design, manufacture, and application of the versatile base materials into finished products for both industrial and direct consumer usage. In addition the rubber industry employs more than 4000 other persons with mechanical-engineering backgrounds who are profitably employing their skills in activities outside engineering.

Not only are mechanical engineers required for design and application of the products, they are also required in the industry's manufacturing and distribution activities. Mechanical engineers are demanded to fill more than one half the industry's total requirement for all types of engineers.

They have many different functions, the two largest distinct functions being product design and machine design and development. In both these cases the functions and responsibilities are much broader than in most other industries.

Product Design

Mechanical engineers in product design utilize not only rubber, rubberlike materials, and plastics, but also textile fabrics and cords, metals, fibers, wires, and cables, with which they must be as well acquainted as with the base materials. Following complete analysis of the product service requirements, mechanical combinations of the base material with the other materials are considered for producing the desired product on a commercial basis and at a cost acceptable to the consumers. This activity involves knowledge of the peculiar techniques of the industry, knowledge of the ultimate application and function of the product, and knowledge of the features which must exist to make the product salable in the face of competition. This means that the product designer collaborates closely and continuously with customers, manufacturing departments, cost departments, sales departments, and scientists and engineers in many other fields.

The responsibilities of the product designer extend even further. After the materials of construction are chosen and the physical design of the product established, a method of manufacture must be developed by the same engineer. This may be an entirely new method or a modification of a previous method.

When a new product is first placed in production, the product engineer is responsible for, and controls, the manufacture until all unforeseen manufacturing problems are solved. It is obvious that the rubber-product designer must utilize his imagination and foresight.

Machine Design and Development

Because rubber manufacturing is unique in industry and constantly changing, each manufacturer must design and build most of his machines. The design of these machines calls for special ingenuity, for frequently there is no precedent to follow. The mechanical engineer in this type of activity not only creates the machine, but creates it in such style that there will be minimum labor cost, minimum waste of material, maximum product quality, and maximum productivity resulting from the operation of the machine.

Mechanical engineers in machine design and development not only design the machines, they follow through on the construction, installation, and initial operation. Each machine is followed closely from the drawing board to full-scale operation by the same engineer.

Industrial Product Sales

The engineer who enjoys contact with customers and customers' engineers succeeds easily in the rubber industry by virtue of his ability to comprehend quickly and analyze correctly customers' requirements. Engineers who choose sales activity receive comprehensive training in manufacturing and application details of the product line and in specific sales procedures. This training is essential because of the wide variety of both products and types of consumers, plus the fact that few educational institutions are able to provide background knowledge in rubber technology.

Plant Engineering

In most rubber-industry plants, plant engineers rank second only to plant managers. They are nearly always selected from the ranks of mechanical engineers. Their function is to see that all of the plant equipment is correctly selected, properly installed and operated, and maintained to insure efficient over-all plant operation.

---

[1] By Donald R. Scheu, Field Engineer, The B. F. Goodrich Company, Akron, Ohio.

Based on three papers contributed by the Education Committee and presented at the Fall Meeting, Denver, Colo., September 10–12, 1956, of The American Society of Mechanical Engineers.

Design of a Manufacturing Plant

The initial and operating costs and the ability of the plant to produce the desired product in the proper quantity and of the desired quality are primarily dependent upon the quality of the design. The basic process outlining the steps and defining the physical conditions which must be met in the plant will have been fairly well established by the previous work. The initial required capacity and probable future requirements will have been considered. However, the design responsibility will include evaluation of the economics of various increments of capacity. It will also include the sizing, selection, or detailed design of each piece of equipment, the means by which heating, cooling, agitation, and other operations will be accomplished and controlled, and the selection of materials of construction.

There are many inherent hazards involved in the manufacture of most chemicals, and design engineers are responsible for designing around these hazards to nsure that the plant will be safe to operate.

The design of chemical plants, with few exceptions, is new and different each time. Plants are seldom duplicated; each plant is a tailor-made unit, normally the only one of its particular kind in existence. Many types of engineers are required in its design, and mechanical and chemical engineers are predominant. Design engineers have ready access to strong research departments to assist in evaluating the more complex chemical problems encountered. A strong design department will integrate chemical and mechanical engineers, and the difference between individuals will be more important than the course of academic study they chose. The mechanical engineer now plays a major role in the field of design, and this role will increase with the growth of the industry.

Construction of the Plant

Construction of chemical plants is not unlike that of the other manufacturing industries. It involves the building of the plant in accordance with the design plan. Engineers are employed to supervise construction, and mechanical engineers are predominant in this activity. They must have sufficient technical background not only to understand the design instructions but also to question any parts which do not appear practical as the plant is built. The mechanical engineer in design works with many people and must appreciate the practical application of his work; however, his major contribution is more technical than that of the construction engineer who supervises and co-ordinates the work of others.

Provision of Service Facilities

The provision of service facilities such as steam for process heating, refrigeration, and electricity, requires the employment of mechanical engineers. Normally, these facilities are provided centrally for an entire plant and must be integrated into the design and construction of each manufacturing unit in the plant. Since the operation of most chemical plants is continuous and completely dependent upon continuity of service of its utilities, the demands on utility equipment and its operation are more exacting than that of the chemical-manufacturing facilities themselves. The fact that a number of patents relating to the design of power-plant equipment are held by chemical companies is evidence of the mechanical design effort devoted to this activity. Mechanical engineers are employed in the design and operation of these facilities throughout the industry.

Operation of the Plant

In some processes the unit operations performed are more mechanical than chemical in nature, and mechanical engineers are more appropriate than chemical engineers. Engineers responsible for operation usually have research and design sections to call upon for assistance in solving technical problems, but they must understand the process, detect problems, and solve many of them on their own. Like the construction engineer, the engineers assigned to operation must work with a large number of people and direct activities of others. Many attributes other than a technical background are required for this assignment.

Maintenance of the Plant

Chemical plants must be maintained as well as operated. The planning, organization, and guidance of maintenance work require a large number of engineers. Most of the engineers engaged in this activity are mechanical engineers. The industry is rapidly recognizing maintenance as one of its more important activities, and in recent years it has elevated maintenance management to the same level as production management. The requirements of maintenance engineers are similar to those of engineers assigned to production, and the tendency to interchange engineers between these two assignments is becoming more common.

Selling of the Product

Due to the high degree of technology related to chemical products and their uses, the selling of chemicals requires many types of engineers. The mechanical engineer is well qualified to sell nonflammable hydraulic fluids, plastics, and many other products of the chemical industry.

Management of the Business

The advancement of an individual in management within the chemical industry is based on his management ability, without particular regard to his specialized field of technical training. In fact, the integration of a variety of backgrounds strengthens the management team. Mechanical engineers have and do play a role in management. In one large chemical company the production manager of the organic-chemicals division and two of the plant managers of the company's four largest plants are mechanical engineers.

Advancement opportunities exist for the individual in the technical field as well as in management. In recent years the industry has established classifications such as scientist, senior scientist, technologist, and senior technologist to provide greater opportunities for advancement of individuals in the more scientific fields such as research and design. These arrangements permit such individuals to advance in salaries and prestige to levels comparable to individuals in higher management levels. As in advancement in management, these positions are not reserved for chemists and chemical engineers but are available to any individual in proportion to his contribution.

the maintenance costs; firstly, on a percentage basis, and secondly, because of increased costs for maintenance of the automatic-control equipment. Maintenance costs are determined, to a large extent, by the plant designers. They determine type of equipment, location of equipment, and materials; they provide for ease of maintenance through ready access to equipment requiring frequent maintenance; and, as one specific example, they provide adequate drainage and filling facilities for testing. The mechanical engineer in maintenance will be called upon to prepare studies and designs to rectify conditions which are deficient.

Experience obtained during the operation of equipment or processes will frequently dictate the replacement of equipment with that of a different design, or substitution of different materials. In this case, the mechanical engineer will be called upon to analyze the problem and to present recommendations for management approval. Whenever the maintenance for a piece of equipment becomes excessive, study and engineering recommendations are indicated. Cases are not unusual wherein a piece of equipment has been replaced with a new design with savings in subsequent annual maintenance expense equal to several times the amortization charges. In many cases these studies require the exercise of extreme ingenuity and the highest form of application of mechanical-engineering principles.

Maintenance in the producing field, in the refinery, or for a chain of service stations usually involves the operation of good-sized mechanical shops, proper selection and maintenance of automotive equipment, and time and work studies, among other applications of mechanical-engineering skills. It involves many of the skills required for original design.

Management

There are two general fields of opportunity in management for the mechanical engineer in the petroleum industry: (1) the management of production units and (2) the general administration of the company. Plant operations are usually attractive to the mechanical engineer, since he maintains close contact with mechanical phases of the business. This phase may remain as the ultimate goal of the mechanical engineer who is reluctant to release this close contact. On the other hand, it may be a step toward positions in company administration.

Mechanical engineers are actually working in all levels of management and in all departments in the oil companies, and they are doing a good job. For example, mechanical-engineering training and experience are an excellent background for a purchasing agent. Sale of petroleum products requires an understanding of the use to which the products are put. In most instances these products are consumed in machinery of one sort or another. The salesman is of more value to his company and to the customer if he has an understanding of the machinery involved.

The physical plant required for the oil business is extensive. As with design, construction of these facilities may be undertaken by company employees. In certain instances, and almost always when large in scope, construction is undertaken by contract with an engineering-construction firm. Construction is largely a management problem, of a specialized sort, and the management opportunities for the mechanical engineer in this phase of the petroleum industry are as real as they are in any of the other branches.

The Chemical Industry[3]

From the viewpoint of industry, quoting the May 15, 1955, issue of *Forbes* magazine, "it takes more than test tube and technology to turn a grimy lump of coal into sleek nylon stockings." Mechanical engineering is a necessity in most of the chemical industry's activities. Mechanical engineering can best be supplied by mechanical engineers. This will always be true; however, the shortage of engineers in all fields makes it even more important that mechanical engineers fill their role in the industry. The following discussion gives a general survey of the mechanical engineer's function in the major operations of the chemical industry.

Finding Uses for the Product

Research chemists are constantly developing new products. The screening and testing of these products for mechanical characteristics are done by mechanical engineers. As an example, many of the commercial aircraft today are using nonflammable hydraulic fluids. The screening of these products for mechanical characteristics involved mechanical engineering, and after this was done a suitable product was selected. Once this basic need had been filled, work continued to find other uses for the product. The material is now being used in air compressors to avoid internal explosions and in a large variety of mechanical equipment to eliminate the fire hazards involved with normal lubricating and hydraulic oils. The study of the suitability of the product to other applications is primarily a mechanical-engineering function. This is only one example of the many fields which require mechanical engineering immediately after a product is discovered.

Development of a Manufacturing Process

The development of a manufacturing process starts with the work of the research chemist but almost immediately requires the application of mechanical, chemical, electrical, and other fields of engineering. This step should not be confused with the design of a manufacturing plant. It is the initial review and shakedown of the research chemist's process to evaluate and explore the avenues by which the product can be manufactured on a commercial basis. It normally ends with a small-scale or pilot-plant demonstration. The discoveries of the research chemist place increasing demands for equipment which can withstand extreme pressures and temperatures and wider flexibility in many other mechanical characteristics. Fundamental research in mechanical engineering to meet these demands is increasing rapidly within the industry.

[3] By W. E. Chandler, Plant Engineer, Monsanto Chemical Company, St. Louis, Mo.

action, on behalf of the societies, in accordance with the information available. A diagrammatic representation of the organization is shown in Fig. 1. A president and vice-president are elected annually from among those who are currently representing, or have previously represented, a constituent society. A secretary and treasurer are appointed to serve at the pleasure of the board. To facilitate the operations of the council, there is also an executive committee which acts on behalf of the board.

Neither the boards of the constituent societies nor their delegates on EJC react to all major problems in the same way. Various segments of the profession view certain matters differently. A function of EJC is to make pronouncements reflecting the majority opinion of the profession. EJC has been successful in this, and generally can and does act promptly and positively when impelling situations affecting the profession arise.

Subsequent to the adoption of the constitution, a committee on unity in the profession was established. On its recommendation, an exploratory group, consisting of representatives of fifteen societies, studied the EJC structure. Included in their recommendations were modifications which would permit enlargement of the council through the addition of associate and affiliate member societies.

Associate Member Societies

The provisions for associate and affiliate society memberships in EJC, incorporated in the constitution in 1954, and implemented with definitive bylaws in 1955, were based on the two-year study by the exploratory group.

Associate member societies are national in the activity and technical interest of their members, differing only in size from the larger constituent societies. To insure adequate breadth of membership interest, the arbitrary figure of 5000 members was selected as minimum for constituent membership. National societies, meeting all other requirements, are accorded associate status until their membership has passed the 5000 figure.

Affiliate Members

The affiliate member societies are composed of either of two types of organizations, or even a combination of both. One is the local or independent regional society, organized and operating for the benefit of the engineers in an area. The other, of greater importance to the readers of this article, is the federation of engineering societies, or local sections or chapters of such societies.

Since all individuals trained in the engineering profession are engineers first and specialists second, there has developed the need for a common medium of expression. The federation of local sections and/or regional societies provides a forum for specialists with the one common interest, the profession of engineering, to become associated in affairs of public interest.

Engineers, as professional persons, are obligated to devote part of their time and effort to matters affecting public interest. In order to help the engineer obtain proper public recognition and professional status, the public must know of him both as an individual and as a member of a group. Many community problems have an engineering aspect, which requires the advice and services of public-spirited individuals within the profession. The federation provides the medium through which the public may call on the individual or the group for the service and help that it needs.

At national level, EJC provides the connecting link between the national societies and the local societies or federations, which find problems in their communities similar to those in other communities and thus look to EJC to aid in finding an adequate solution.

Purpose of Federations

Technical development of the individual is essential, and is the main function of his local section, but the value and benefits of such development can be of material assistance to the public only if made available by organized group action. Local federations act as the catalyst for the individual engineer in his relations with the public on the level of his community or state. This procedure is being followed at national level through the assign-

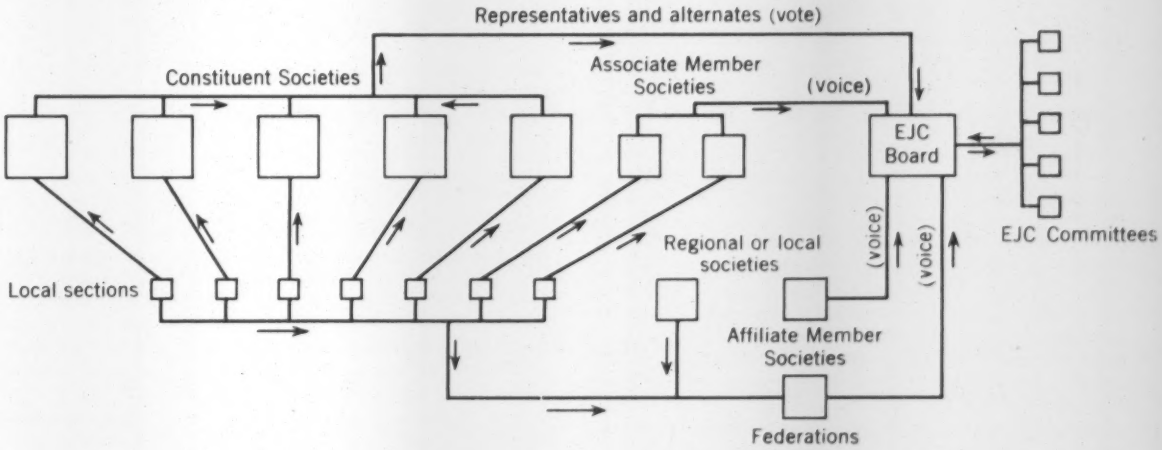


Fig. 1 Organization of Engineers Joint Council is shown graphically. The number of squares is illustrative only.

EJC and Affiliate Member Societies

By E. Paul Lange

Secretary, Engineers Joint Council, New York, N. Y.

THE profession is represented by engineering societies formed of individual members having a common technical interest. To facilitate communication between members, local sections or chapters of national societies have been formed to operate in communities or geographical areas. In addition, there are many local or regional engineering societies composed of members from the several branches of engineering.

The technical phase of the profession has been developed to a high degree by each society, but the impact of the profession on the public by the individual, his local section, or national society requires a co-ordinated effort by all the segments of the profession. Engineers Joint Council provides the medium for this effort.

Historical Background

The history of EJC was carefully documented by T. A. Marshall, Jr., in the July, 1954, issue of MECHANICAL ENGINEERING. In its present form, EJC was created from Engineers Joint Conference, composed of the presidents and secretaries of five societies. In 1945 the council structure was reorganized, and its present constitution adopted, representation being drawn from the boards of the constituent societies.

That engineering is a profession is generally accepted. Unity within a segment of the profession is an accomplished fact, as evidenced by any of the national engineering societies composed of members with similar technical interests. Unity within the profession is a goal yet to be achieved.

A Democratic Organization

As the member societies in special fields of engineering serve their members in their specific technical areas, so EJC enables the individual engineer to make the greatest possible contribution to the national welfare and economy by promoting public recognition of the engineer.

Engineers Joint Council represents the individual engineer as much as it does the engineering societies which make up its membership. EJC's constitution provides for management by groups of officers, directors, and committeemen whose tenure is as brief as is compatible with efficient functioning. For these reasons, domination by any one group or clique is precluded and representative policy assured.

EJC was established in spite of the difficulties inherent in the organization of federations. Strong national societies in the several fields of engineering have developed over the years. The majority of engineers, unlike individuals in other professions, are employees rather than individual entrepreneurs. As a result of the character of their employment, therefore, there exist wide differences in individual attitudes toward the profession and toward the public policy concerning engineering. The constitution and bylaws, under which the council functions, recognize these facts. The effectiveness of EJC in reflecting a majority opinion of the profession has already been successfully demonstrated in a number of areas.

The mechanics of accomplishing the objectives of EJC, which are continually subject to change as current conditions demand, are based on a democratic organization set up by EJC's constitution.

EJC Structure

The EJC board of directors is composed of representatives, who are individually members of the boards of the constituent societies they represent, and alternates, who may or may not be members of that society's board, at the option of the society. This option permits wider geographical distribution of society representation. The EJC board meets regularly to consider developments affecting the engineer and the engineering profession as a whole. If the situation calls for a group to investigate and report, the board appoints such a committee. The committee, in turn, reports back to the board, which accepts or rejects the findings of the committee and takes

Changes in EJC

In order to make Engineers Joint Council truly representative of the entire engineering profession, several changes have been made in its structure. Associate and affiliate classes of membership have been added and the EJC board altered.

Associates lack only the 5000 member minimum to have the same constituent member status as the five technical societies which originated EJC in 1945. Affiliate members are individual local or regional societies, or, more commonly, federations of them.

These federations are a new type of organization which will have the same function at the state or community level that EJC assumes nationally—the handling of profession-wide relations with the public.

Both associate and affiliate members will have a voice in all meetings of the EJC board, but will vote only at the annual meeting.

Based on an address, April 19, 1956, before the Pacific Southwest council of local sections of the American Society of Civil Engineers.

Utilization of Lignite

A comparison between spreader-stoker and pulverized-lignite firing in steam generation

By Earl C. Miller[1] and C. Freeman Hawley[2]

Riley Stoker Corporation, Worcester, Mass.

THE development of lignite utilization was actually nurtured in our North Central States and South Central Canada where vast fields of lignite exist and the methods of lignite firing used in North Dakota, South Dakota, Montana, and Minnesota have, in general, set the standards used in all of the other lignite areas of the world.

Initially, lignite was burned under small-sized boilers, and during the 1920's and 1930's the spreader stoker was the popular type of fuel-burning equipment for the smaller units under 30,000-lb-per-hr capacity. From 1910 to 1945 the traveling grate was used almost exclusively with units over 30,000 lb per hr and up to 100,000-lb-per-hr capacity. This division in selection of types of stokers was mostly influenced by cost and it continued until about 1945 when the use of the spreader stoker started with boiler sizes formerly fired by traveling grates.

Since 1945 the spreader stoker has been used almost exclusively in the firing of lignite. However, a few pulverized-lignite-fired units have been installed.

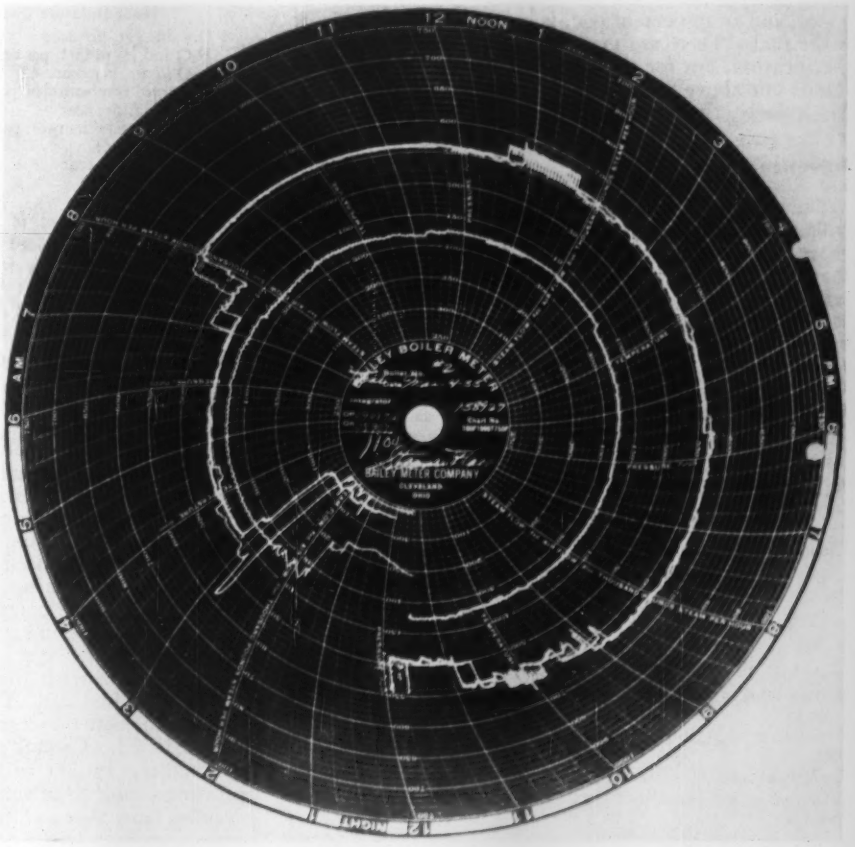


Fig. 1 Steam flow chart, showing the rate of load change permissible in spreader stokers

Spreader-Stoker Firing of Lignite

In the early 1920's spreader-stoker firing of lignite in the Dakota and Canadian lignite field areas became popular for the HRT boilers of heating plants, because of the ease of installation, ease of bringing the boiler up to load, and the ease with which load could be changed. The rate of load change permissible in spreader stokers is illustrated in Fig. 1 in which the load was increased from live bank to 70 per cent of full load almost instantaneously. Such operation is out of the question with traveling-grate or chain-grate stokers. There is no question, however, that fewer problems are presented with spreader-stoker-lignite firing than with any other fuel. A completely water-cooled boiler with spreader-stoker firing operates over a load range from a live bank to full load without signs of distress to either the grate surface or furnace. Smoke is nonexistent with modern units having over-fire air for control of flame. At the Crookston plant of the Otter Tail Power Company on a 75,000-lb-per-hr spreader-stoker-fired unit the load will range from live bank to full load during a 24-hr day.

Free-burning lignite produces much less fly ash than

[1] Research Engineer. Mem. ASME.

[2] Chief Mechanical Engineer. Mem. ASME.

Contributed by the Power Division and presented at the Fall Meeting, Denver, Colo., Sept. 10–12, 1956, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Condensed from ASME Paper No. 56—F-22.

ment of more and more problems of public interest to EJC, with the national societies continuing their traditional role of promoting development of the profession in their field. A similar separation at local level permits flexibility in the activities of a local group without posing the legal problem of the right to take part in local, state, or regional legislative matters.

Flexibility of Local Groups

Some national societies have instructed their local sections or chapters that they cannot, as an integral part of such a national organization, take an active part in local nontechnical matters. The reason for this is that the actions of a local section might be construed as a reflection of the policy of the national organization with respect to the specific local situation, particularly where such a local problem might easily have a national connotation.

Positive action, which can be taken by national societies on legislative matters, is limited by the strict regulations of the Bureau of Internal Revenue. All member societies of EJC have requested and been granted classification as nonprofit organizations under the Internal Revenue Code, Section 501(c)(3). This section permits individuals to make gifts, bequests, or donations to the societies which are tax-free to the donor. However, if the societies should devote a substantial part of their activities to attempting to influence legislation by propaganda or otherwise, this privilege would be rescinded and the other advantages of this classification would be lost.

Advantages of Federations

Although EJC is also a nonprofit organization, it is classified under Section 501 (c)(6), which is defined in the Code as a "business league." Gifts or bequests made to a business league are taxable to the donor. The activities of a business league may be directed to the improvement of business or professional interests for the benefit of the organization.

The line of demarcation between activity in the legislative field and lobbying is not clear-cut. However, from discussions with the Bureau, it would appear that activity in the legislative field refers to interest in the policy inherent in the legislation, while lobbying is construed as positive action taken on a specific item of legislation. EJC has a long-established and well-defined interest in the policy contained in legislation affecting the engineering aspects of the development of the country but in no instance has it taken a positive stand on a specific item of legislation.

Local federations, whether state or regional, if formed and operated along the same pattern as EJC, would probably be permitted the same latitude of action within their fields of interest. Each individual case must be examined on its own merit.

A federation of local engineering groups could be a simple answer, since a federation is in itself an entity. A federation is composed of duly elected or appointed representatives from each of the local groups. The policies of the federation are an accurate reflection of the policies of the member engineering groups. Each local section, chapter, or independent society contributes a nominal amount for the financial support of the federation. Declarations of policy are the right of the federation, rather than of its individual components, because for the federation is the reflection of unity and strength.

Objectives of EJC

1 To advance the general welfare of mankind through the available resources and the creative ability of the engineering profession.

2 To promote co-operation among the various branches of the engineering profession.

3 To advance the science and the profession of engineering.

4 To develop sound public policies respecting national and international affairs wherein the engineering profession can be helpful through the services of the members of the engineering profession.

Federations and EJC

The relation of EJC to this picture is simple. A local federation enhances its effectiveness by becoming an affiliate member society of EJC. A national policy has no value unless it has the support of the local members; the individual engineer cannot know accurately what the national policy actually is and how it may affect the community in which he lives except through group action.

The question has often been raised concerning the advantages of dual representation in EJC. One comes through regular membership in a national society with the society board representatives speaking for their members at the EJC board. The other comes through an observer from a federation, which has a voice at all meetings of the EJC board and a vote at the annual meeting of the board. Each serves a specific purpose. The national society board member reflects the considered opinion of the majority of the members at the national level, while the observer from the federation brings to the EJC board the specific policy problems of the area which he represents. The opinions of each are essential to the establishment of satisfactory basic policy that will be of value and benefit to the profession and the public which we serve.

Future of the Profession

Science is continuing to provide engineering with ever-expanding vistas. The utilization of new metals, the applications of nuclear phenomena, the harnessing of the vast store of solar energy, electronic and mechanical developments in automation, increasingly invest the engineering profession with social as well as technological responsibilities. The activities of this influential and representative federation of engineering groups striving to bring to bear the weight of the entire profession on these problems should stir the imagination and enlist the support of every engineer.

Table 3 Performance for 250,000 Lb-per-Hr Maximum Continuous-Rated Spreader-Fired Boiler Designed for 925 Psi—905 F

Fuel	Actual	Design
Evaporation, lb per hr	251,000	250,000
Feedwater temperature, deg F	370	360
Gas temperature leaving boiler, deg F	731	765
Gas temperature leaving economizer, deg F	625	630
Draft losses—total, wg	7.0	8.5
Air pressure losses—total, wg	3.3	5.3
Fuel fired, lb per hr	45,775	53,300
Gas leaving air heater, deg F	361	390
Air leaving air heater, deg F	360	425
Combustion rate, Btu/cu ft	20,200	19,700
Excess air, per cent	24	30
Heat Balance Losses		
Dry flue gas, per cent	7.37	7.8
H_2O and H_2 in fuel, per cent	9.26	10.32
H_2O in air, per cent	0.18	0.18
Unburned combustible, per cent	0.95	0.7
Radiation, per cent	0.50	0.5
Manufacturers' margin, per cent		1.5
Total, per cent	18.26	21.0
Efficiency, per cent	81.74	79.0

Table 4 Comparable Steam Generator Data—Spreader Fired Versus Pulverizer Fired for 160,000 Lb per Hr at 850 Psi and 900 F. Fuel—North Dakota Lignite at 6600 Btu, 36.4 Per Cent Moisture

	Continuous Discharge Spreader Stoker	Pulverizer (4 Burners)
Total station horsepower for firing equipment	51.5	502
Total horsepower required for firing equipment at 160,000 lb per hr	49	425.6

The coarser pulverization does reduce power consumption, but to save on power at the expense of fineness can result in furnace fouling. This is particularly true in cases where burners are placed so that impingement on the walls occurs from the large particles that carry out from the burners. Impingement from burning particles invariably results in slag adhesion.

Colorado Subbituminous Coal—"Lignite." There should be some mention of Colorado and Wyoming subbituminous coals which are sometimes called lignites. These fuels have a moisture content of 20 to 24 per cent compared to 34 to 40 per cent with lignite, and are satisfactorily burned on spreader stokers or in pulverized form. Several large units of central stations use this Colorado fuel in pulverizers, and pulverized-subbituminous-coal units as large as 1,000,000 lb of steam per hr are projected.

Wet-Bottom Firing of Pulverized Lignite. A new furnace design, featuring a slag-tap bottom and opposed firing from opposite walls has recently appeared that offers advantages for the efficient firing of pulverized lignite in large steam-generating units. This new design is shown in Fig. 2. The unit illustrated has a capacity of 825,000 lb per hr and is designed for pulverized-lignite, gas, and oil firing.

Most of the following advantages of this furnace design are particularly important when lignite is burned:

1 High temperature and turbulence in the combustion zone which is especially beneficial for burning high-moisture fuels.

2 Reduction in fly-ash carry-over.

3 Reduction of slag on the upper furnace and screen tubes.

4 Reduction in carbon loss.

5 Ability to turn to molten slag all the collected fly ash and hence reduce it to an easily-handled product.

6 Auxiliary fuel such as oil or gas can be efficiently burned.

7 Uniform distribution of gas. This is shown by the Delta T isothermal lines plotted from thermocouple readings, Fig. 3, on the furnace walls of a boiler unit with furnace design of the type shown in Fig. 2. The cleanliness of this particular furnace is well known and the absence of soot and slag deposits on the walls and convection tube bank has been reported by Feeley (4).

8 Lower over-all height than conventional firing.

Conclusion

Spreader stokers will dominate the lignite-firing field in units of capacities to 250,000 lb per hr because of its relatively low cost, low power consumption, and ability to operate effectively over an extreme load range. The 250,000-lb-per-hr unit in Fig. 4 illustrates the modern lignite installation. This is the largest of the raw-lig-

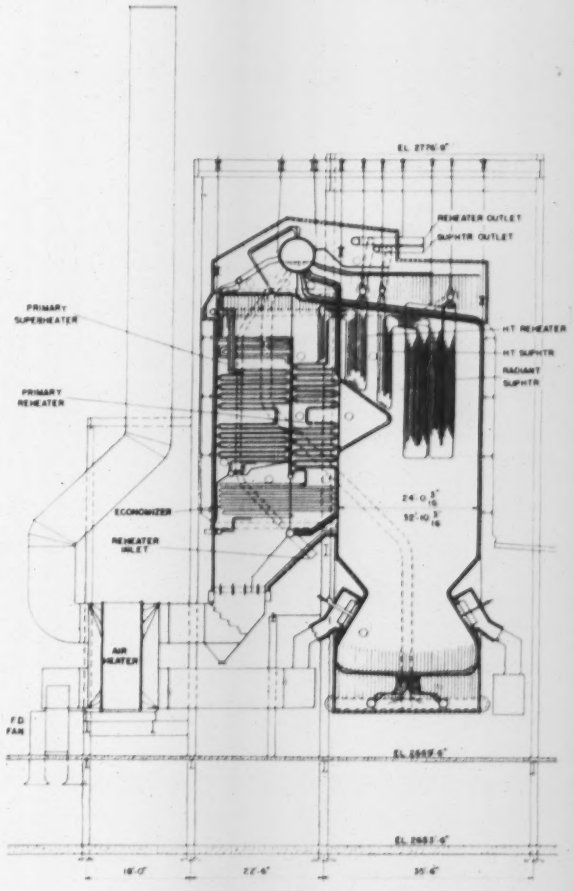


Fig. 2 An 825,000-lb-per-hr unit designed for pulverized lignite, gas, and oil firing, features a slag-tap bottom and opposed firing

bituminous coals. Furthermore, carbon content in the fly ash is lower, resulting in complete burnout as it continues through the boiler passes. In contrast, fly ash of bituminous coals stops burning when gas temperatures drop as they travel through the boiler passes. This burning characteristic of lignite fly ash, although definitely advantageous in reducing pollution, dust nuisance, and in minimizing carbon loss, does require special consideration in boiler design. Burning characteristics of lignite, its moisture content, and fusion temperature, definitely favor spreader-stoker firing.

While the work of stoker and boiler designers plays an important part in the success of spreader-stoker units, one factor, and an important one, is beyond their control: it is the fuel. There are many points in a complete fuels specification, but for the spreader-stoker user one factor stands out above all others—it is size consist, and most particularly, the uniformity of the size consist.

Pulverizer Firing of Lignite

The pulverizer has certain advantages over the spreader stoker in the firing of lignite with boilers of steam-generating capacity of 250,000 to 400,000 lb per hr. As the width of the stoker increases, greater must be the attention given to fuel-size consist and size segregation. The problems of design and operation of coal conveyers, bunkers, and coal spouts are far more critical for large spreader stokers than for pulverizers.

Both pulverizers and spreader stokers can operate on a wide variety of fuels. Where capacity is affected by variation in fuel, the pulverizer is more versatile. The influence of fuel quality and grindability or pulverizer capacity and cost is shown in Table 1.

Table 1 Influence of Coal Quality and Grindability on Pulverizer and Spreader-Stoker Costs

(Fuel-Burning Equipment Only)

	Coal				Lignite
Steam load, lb per hr	175,000	175,000	175,000	175,000	175,000
Heating value of coal, Btu per lb	14,000	12,000	10,000	8,000	7,000
Coal consumption, lb per hr	18,000	19,000	23,000	28,000	34,000
Grindability of coal	90	70	60	50	40
Relative cost, spreader stoker	1.0	1.0	1.0	1.0	1.1
Relative cost, pulverizer	1.1	1.25	1.4	1.6	1.9

With gas and/or oil as a supplementary fuel, units firing pulverized lignite are more economically adaptable, since burners used with pulverizers can be installed with oil and/or gas firing equipment at a relatively insignificant cost.

Pulverizers for lignite must be larger than those firing bituminous coal because of lignite's low heat value and high moisture content. According to Cowles (1)[1] power consumption of pulverizers is approximately ten times that of spreader-stokers firing steam-generating units of the same capacity and same over-all efficiency Table 2.

Performance of Lignite-Fired Boiler Units. Performance of lignite-fired boilers is dominated by (*a*) percentage of moisture of the fuel and (*b*) excess air. The influence of moisture on over-all performance is independent of the firing methods, but does amount to a considerable loss. Moisture is the principal factor in the comparative over-all efficiency of lignite-fired boilers and comparable boilers fired by higher grades of bituminous coal. Moisture also influences fan and pulverizer selection.

Table 2 Performance for 240,000-Lb-per-Hr Maximum Continuous-Rated Pulverizer-Fired Boiler Designed for 1290 Psi, 800 F

Fuel	Design
Evaporation, lb/hr	260,000
Feedwater temperature, deg F	274
Gas temperature leaving boiler, deg F	820
Draft losses—total, wg	11.45
Air pressure losses—total, wg	5.70
Fuel fired, lb/hr	47,100
Gas leaving air heater, deg F	385
Air leaving air heater, deg F	630
Combustion rate, Btu/cu ft	20,000
Excess air, per cent	26
Heat Balance Losses	
Dry flue gas, per cent	7.23
H_2O and H_2 in fuel, per cent	9.68
H_2O in air, per cent	0.17
Unburned combustibles, per cent	0.42
Radiation, per cent	0.50
Manufacturers' margin, per cent	1.5
Total, per cent	19.5
Efficiency, per cent	80.5

The difference between excess-air prediction for pulverized-lignite-fired and spreader-stoker-fired units usually accounts for the difference in predicted performances. This is not so with spreader stokers. The performance of spreader stokers will be greatly influenced by the uniformity of the fuel reaching the distributors. The excess air for spreader-stoker units is normally predicted higher than that for pulverized-coal-fired units to provide a reasonable margin to insure ease of operation. An example of this is the comparison of excess air shown in Tables 3 and 4 covering spreader stokers and pulverizers, respectively. The spreader-stoker excess air can be brought in line with the pulverizer performance with uniformity of fuel size. This is the case shown in Table 3 in which the actual excess air is considerably lower than that predicted. Careful attention to the layout of the fuel-handling system to the feeders, greatly simplifies operating problems of spreader-stoker firing.

Fouling From Slag and Ash. The ability of lignite to continue to burn in the cooler areas of the boiler passes, coupled with the peculiar characteristics of its ash, creates problems in fouling that generally do not occur with the higher grades of bituminous coal. Particles of fly ash leaving the furnace continue to burn in the boiler passes, and the furnace-gas exit temperature must be held well below the softening temperature of the ash or these burning particles will create a slag problem in the screen and superheater tubes. As a consequence, it is important to provide a liberal furnace-heat release with respect to both furnace and furnace envelope. Considerable turbulence is required in both types of firing to maintain the shortest possible flame, but even then a greater furnace volume must be provided than would be needed for bituminous-coal firing.

Because of the ease with which lignite burns, a stable flame can be obtained in pulverized-coal-fired units without the fineness normally expected for the other fuels.

[1] Numbers in parentheses refer to the Bibliography at the end of the paper.

Recent Technical and Economic Developments in Western Europe

By **Frederick S. Blackall, jr.**, Past-President and Fellow ASME

President and Treasurer, The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

Mr. Blackall, past-president of ASME, has recently returned from a two-month trip which embraced Italy, Greece, Turkey, Vienna, the industrial section of south Germany, Switzerland, northern Italy, northern France, Ireland, and England. Here Mr. Blackall describes technical, economic, and sociological impressions of these countries as seen through the eyes of a keenly aware engineer and businessman who, even while vacationing, keeps a "weather eye" open.

By Mid-1956 and at least until the recent outbreak in the Middle East and the shocking rape of Hungary, postwar Europe seemed at long last to be achieving something approaching a certain stability. In the areas of economics, finance, and technology, normal patterns were beginning to be established. Some of the vanquished were emerging from their interim chaos with new and, one hopes, more wholesome strength; some of the conquerors were displaying weaknesses which only prove how hollow victory may be. This kaleidoscope of a trend to the new normalcy begins to be evident in a trek across western Europe.

The following observations and impressions of the areas I visited recently will be sociological, economic, or technical, depending upon the nature of the things that engaged my attention and the particular interests which drew me to one place or another.

Great Britain Visited

Let me begin with England and the Machine Tool Exhibition at Olympia, which was the major purpose of our trip.

Industrially and economically, England is booming. Unemployment is virtually nonexistent; there is an acute shortage of labor. The shops are filled with goods, generally of good quality although not up to prewar standards. As of early summer, 1956, there had been some layoffs in the automotive industry, and strikes were threatened as a result. However, the British automotive industry poses a special situation. Wages of the auto worker are substantially higher than those in any other line of activity. Thus the auto worker would rather loaf on unemployment benefits under the far-flung Social Security Plan than to scramble for another job.

As on the Continent, the discrepancy between British and American wages has broadened rather than shrunk during the past few years; that is, U. S. wages have risen much more rapidly than European ones. A first-class jig-borer operator or a tool and diemaker gets only about 90 cents per hour in England, this rate being far higher than the average machine-tool operator's rate which would hardly exceed 60 to 70 cents per hour. Engineering draftsmen will earn only $2240 to $2500. Small wonder that England can undersell the U. S. in world markets!

Yet the fact that she cannot price her goods at a half to a third of our prices seems indicative of a relative lack of efficiency. Indeed, many observers fear that England is pricing herself out of world markets, especially in competition with Germany, Switzerland, and Scandinavia.

Although Britain is booming internally, even to the point of serious price inflation, one senses that she is enjoying in some respects a false prosperity. While Americans are constantly urged to import more goods from Britain, British imports from the dollar areas are held to the lowest possible minimum by rigid exchange controls and rigorous import restrictions imposed by the British Board of Trade.

With free convertibility of sterling into dollars further away than ever, it seems inevitable that the wall of isolation which Britain is building up around her industries will weaken rather than strengthen her in the long run.

British Machine Tool Show

My main objective was to visit the British Machine Tool Show which is held every four years at Olympia, London's great exhibition hall, where our company had its surface-grinding equipment on exhibit. This year's show was large and impressive, with some 1500 machine tools on display representing all of the western European nations plus the U. S. There were even a few machines from behind the Iron Curtain, and a large delegation of Soviet engineers was on hand to pick up ideas. However, there was not very much on display at Olympia which was newer or more significant than what we all saw at the U. S. National Machine Tool Show in Chicago, Ill., in September, 1955.

Many machines were exhibited with automatic controls, electrically or electronically actuated. As usual, I was impressed with the continuing advances which Europeans, including the British, are making in the field of optics. Optical measuring and setting devices on such machines as jig borers and precision grinding machines were available in a wide variety of types and purposes.

Copying lathes and milling machines were even in greater evidence than at the previous show in 1952. The presence of a substantial number of British-built U. S. machines was indicative of the increased interest of U. S. manufacturers in licensing or other European manufacturing arrangements. Examples were Brown & Sharpe Automatic Screw Machines (B. & S. is erecting its own plant in Plymouth, England); the British-built

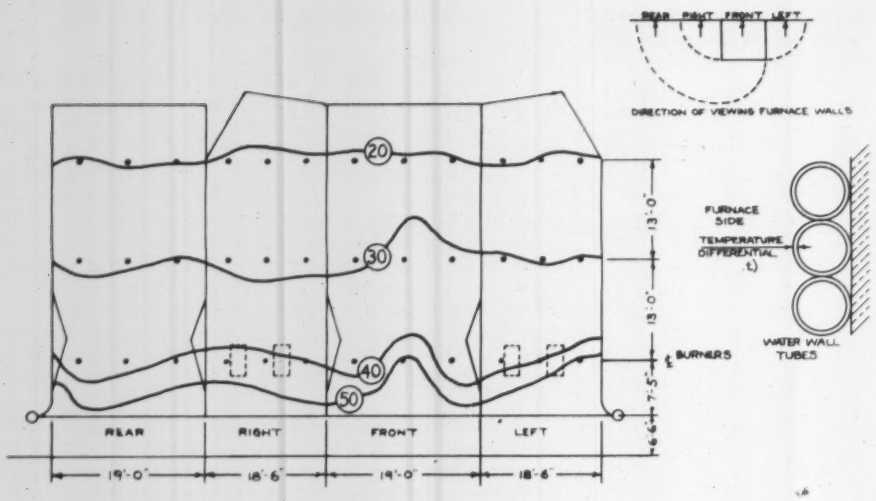


Fig. 3 Isothermal chart plotted from thermocouple readings on the furnace walls of a boiler unit

nite-burning jobs equipped with the spreader stoker in the United States and the basic data and performance are shown in Table 3.

The furnace is liberally designed both with respect to furnace volume and heating surface. Furthermore, the high furnace provides adequate combustion-gas distribution and flame travel. The boiler, economizers, and air heaters have been carefully designed to prevent ash adhesion and build-up.

A large number of installations from 250,000 to 400,000-lb-per-hr capacity will be spreader-stoker-fired. The decision in this range will be largely one of first costs versus operating costs including the power required for pulverizers. Designs of spreader-stoker-fired units are available with capacities up to 400,000 lb per hr.

Units above 400,000 lb per hr would appear more suitable for pulverizer firing. The use of the furnace described in Fig. 2 insures the efficient use of lignite as the sizes steadily increase.

Lignite is a special fuel that can be utilized efficiently, but only with careful attention to fundamental design requirements and details.

Bibliography

1 "Design and Operational Aspects Regarding Utilization of North Dakota Lignite in Steam-Generating Units," by H. R. Cowles, presented at the ASME Fall Meeting, Milwaukee, Wisconsin, Sept. 8–10, 1954. ASME Paper No. 54—F-2.

2 "Technology of Lignite Coals, Part I," U. S. Bureau of Mines, Information Circular 7691.

3 "Technology of Lignite Coals, Part II," U. S. Bureau of Mines, Information Circular 7692.

4 "Fly-Ash Refiring," by F. G. Feeley, Jr., Transactions ASME, vol. 78, 1956, pp. 1747–1755.

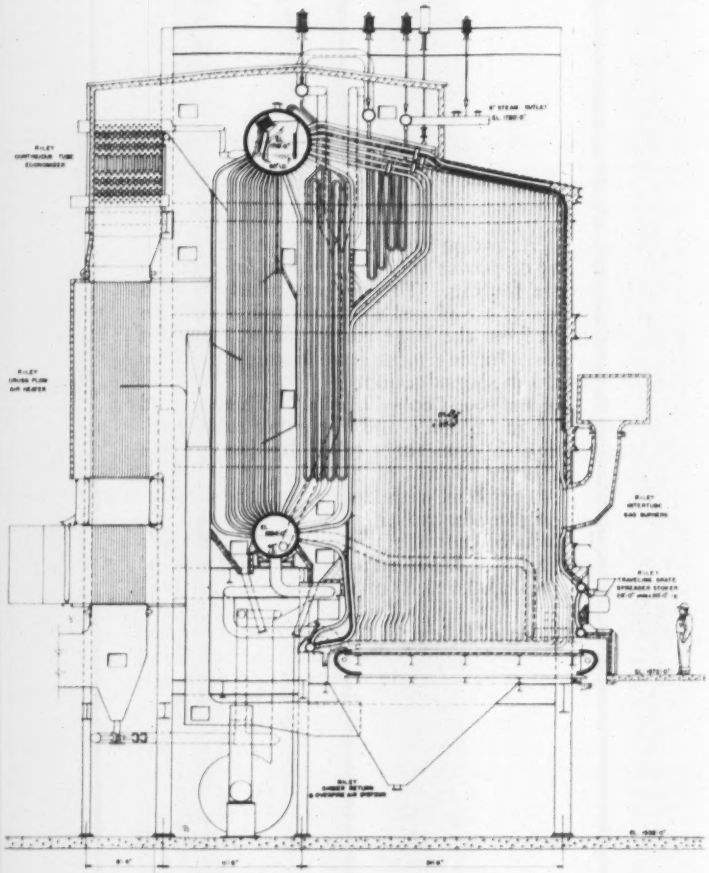


Fig. 4 A 250,000-lb-per-hr modern lignite installation, the largest of the raw-lignite-burning furnaces in the United States equipped with the spreader stoker

days, it was impractical to move the equipment into the American Zone. So the colonel secured a list of some 70 or 80 key men possessing special technical proficiency, who, in the judgment of Zeiss's managing director, Herr Dr. Heinrichs, would be able to reconstruct the Carl Zeiss line, from skill and memory, at another location. This distinguished delegation, having no stomach for the Russians, submitted themselves to the orders of the United States Army, which shortly set up a new plant for them in the Bavarian foothills at Oberkochen. There, in the space of a short two or three years, working with a devotion for which it would be hard to find a parallel, they duplicated all of the essential features and products of the original Carl Zeiss organization. In the process they improved the design of many of them.

In the industrial environs of Stuttgart is the amazing little grinding machine plant of Karl Jung at Goeppingen. I have never seen a finer example of the fabled German technical efficiency. Though but a division of a large company, it is unique in having been built to operate autonomously in the manufacture of a single machine tool—the Karl Jung surface grinder. Operating at its full capacity of one machine per day, the plant is sold out for many months ahead.

Dr. Hofmann, the impresario of this operation, has startlingly unconventional ideas of production and control. For example, he has an office in every department, spending a certain amount of time in each daily, to keep in touch with every facet of production. Here are some more of Dr. Hofmann's ideas:

Every machine in the plant is replaced with a brand-new model when it becomes five years old.

Subassemblies are put together by operators seated at individual tables provided with drawers and shelves within reach for all component parts.

All machines are operated at predetermined optimum speeds and feeds, and employ high-production cutting tools.

Snagging of castings is completely eliminated by shot blast.

Hot lacquer is used in the spray-finishing of all painted parts, eliminating the use of thinners and speeding up drying. This process, now available in the U. S., requires less paint and produces a superior finish.

Detailed study is given each part to determine the optimum metallurgical specification; lightweight alloys, including a new one of aluminum called "Hytronium," are used extensively.

To my surprise, few American machine tools were evident in any of the German plants I visited. Most machines were of German make, although some Swiss, French, Swedish, Italian, and English machines were used—and here and there a Czechoslovakian. Engineers here report that the machines built behind the Iron Curtain are reasonably good in quality but display little in the way of new ideas and development, being largely copies of existing machines or older models. There is an active machine-tool industry both in Czechoslovakia and East Germany, especially in Berlin and its Iron Curtain suburbs.

The impact of American methods is very evident in West Germany, particularly in the new construction boom brought about by the replacement of bombed-out structures. Even the supermarket is making its appearance. American manufacturing methods have left their mark, too, for present-day practices compare very favorably with the best of our own, which was not always true.

Economically, Germany has recovered rapidly. She is outproducing and outselling most of the nations of western Europe, setting a pace which few of them can match. Her currency is one of the soundest in Europe—thanks in part to her low national debt and partly to her defense budget, which, despite occupation costs, must be lower than that of most major nations.

Swiss Precision

Switzerland, our next stop, is the world's largest producer of watches and fine instruments. The Swiss have also made important technical contributions to the development of electrical machinery and high-precision machine tools. They rank close to the Germans as suppliers of the latter to European manufacturers.

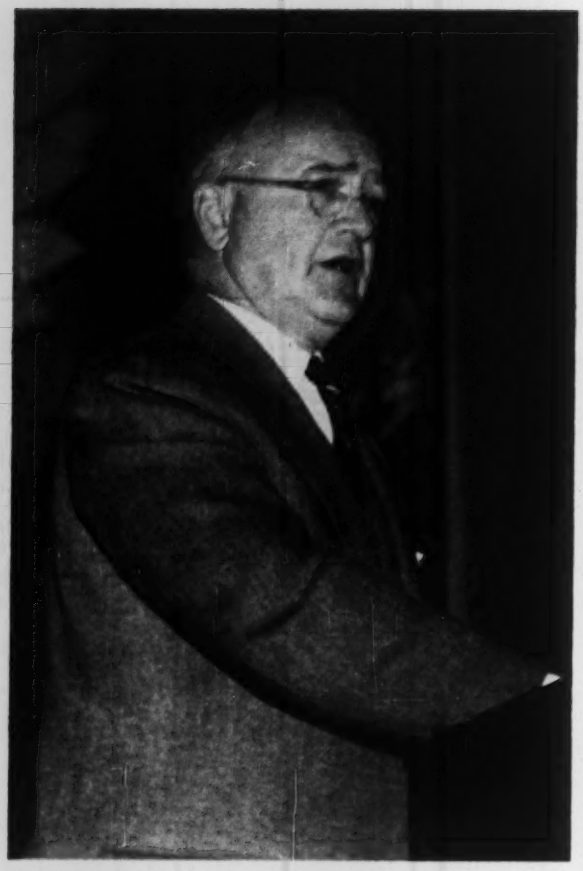
The Swiss jig borer, product of the Société Genevoise d'Instruments de Physique, or SIP, at Geneva, was for years virtually the only European machine tool which successfully competed with Americans in their own market. It is still one of the leading sellers in its field, not only here but throughout the world. In no plant anywhere have I seen more thorough measures taken to insure precision of product. Swiss craftsmanship can also be seen at its best at the model plant of Henri Hauser at Bienne, a competitor of SIP in the jig-borer field and builders of Europe's leading jig grinder. These people have shown scant interest in the U. S. market, but their name and fame are something to conjure with throughout western Europe.

At Tesa's plant near Lausanne, busy artisans were making components of an internal micrometer of their design for Brown & Sharpe, which B. & S. completes in Providence for sale in the U. S. market. An interesting switch, however, was Tesa's building in Switzerland Brown & Sharpe's own vernier caliper, marked "Brown & Sharpe Manufacturing Company—Swiss Made," for sale by B. & S. in this country. In establishing an industrial relationship of this sort with an overseas producer, Henry D. Sharpe, Jr., is displaying laudable initiative and vision.

Italy's Industry

In our sortie into northern Italy we stopped first in Turin, the Detroit of Italy, and one of her two great industrial cities. Here are the headquarters of FIAT, Italy's biggest corporation, comparable in the extent and variety of its products to General Motors, with sixteen or eighteen plants in Turin alone. We toured the wide aisles of their great automobile plant and noticed many American machine tools. Air gages, chiefly the French Solex, were widely used; This is a high production operation. Interesting point of auto design: FIAT's largest-selling model, a baby car by American standards, has no chassis. The body itself provides the structural strength, the wheels and axles being hung directly on it. One wonders what would happen to it in a serious crash.

Nothing I saw in Europe alters my opinion that American automobiles are far superior to their foreign counterparts, class for class. In appearance, stamina, performance, and quality, American cars lead the world. Of course, the high price of gasoline and heavy taxes based on horsepower have brought about an intensive development of small motor vehicles abroad. If you



F. S. Blackall, jr., in a popular role—speaking at an ASME function

Moore jig grinder made by Catmur, the Cincinnati line, long built in England and Holland; Cone automatics and Jones & Lamson Fay automatics, built by Churchill-Redman; National Acme machines built by B.S.A.; American Broaching Machines made by Coventry Gauge & Tool Company; and LaPointe's own British-built product.

There was the usual assortment of transfer machines and excursions into "automation," which were in some cases no more automatic than the name, and in others were the real McCoy. This paralleled the situation at Chicago. An increasing number of British machine-tool and accessory builders are developing package units, such as boring heads and drill heads for use on special transfer applications. Some of these were painted fire-engine red!

Many of the machines at Olympia were painted a pleasing light green, a color more restful to the eye than the U. S. machine gray. It should be adopted as an optional American Standard.

Newall and Kearns both are using a British Thompson-Houston electronic optical control for positioning their jig borer and boring mill tables, respectively. While no doubt accurate, it seemed inferior to the SIP optical system used on the Hydroptic jig borer which I still regard as the finest machine of its type in the world. Newall continues to build the lapped cylindrical plug-gage type of locating device for its old model jig borer, but general opinion is that this construction is now obsolescent.

British Ferranti showed two extremely interesting devices. One is a tape recorder which can be used to control and position machine tables. The other is a measuring instrument which produces interference lines on a pair of diffraction gratings in the usual manner, but reads them by means of a photoelectric cell. This device is said to be applicable to high precision measurement either in a measuring machine per se, or as a machine-tool attachment.

There was a substantial assortment of spark or electronic-erosion machines, including one from the U. S., which I understand will be built by Catmur under license. Three of the spark-erosion machines were from Czechoslovakia, behind the Iron Curtain, and one of the spark disintegrators was of Swiss manufacture.

A number of air gages were on display, including the British Mercer and Sigma, and the British-built but French-owned Solex and French Etamic. None of them, in my judgment, was comparable in quality or performance to any of the two or three leading U. S. air gages.

German Technical Progress

West Germany is in many ways the fabulous nation of modern times. Despite her background of negativeness and destruction, she is emerging as perhaps the most efficient industrial nation in western Europe. Her manufacturing plants are among the best you will find anywhere. Her machine-tool industry is capturing the markets of England, France, Switzerland, Scandinavia, and most of our own erstwhile machinery export business. Her automobiles, trucks, and buses are becoming commonplace throughout Europe, South America, and the Orient; the Volkswagen is already widely sold in the United States.

One reason for Germany's progress is that the German people are giving a day's work for a modest day's pay, on a 48-hr week straight time basis. Labor rates for first-class toolmakers, boring-mill operators, and so on are not over 62 to 75 cents per hour; the average German labor rate for machine shops, including all categories, is about 50 to 55 cents per hour. The spread between German and U. S. labor rates is greater than it was on my last visit four years ago.

The tempo of work at such plants as Heller (machine tools), the Zeiss Optical Works, and others, compared favorably with best U. S. practice. Carbide tools were in use wherever practicable. Plant and machinery maintenance practices were excellent.

Americans should take special pride in the Carl Zeiss story, for it was the fast thinking of an American colonel which saved that great technical institution for the free world. This famous company was originally located in Jena, which was occupied by U. S. troops during the final fast-moving days of World War II. It soon became clear to the commanding colonel, however, that the Russians were going to take over. Fortunately, he had the foresight to realize what a staggering blow it would be to the West if it were to lose the special competence possessed by Carl Zeiss in the design and manufacture of fine measuring tools and scientific instruments based on the optical system. Since the Russians were scheduled to move in within two or three

Briefing the Record

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., *Editor*

Nuclear-Reactor Shell Stresses

A WAY to see and study the complicated stresses existing deep inside the solid-steel pressure vessel of a power-producing nuclear reactor has been found by scientists at the Westinghouse Research Laboratories.

The technique uses a model made of special plastic to make visible the stresses in the full-scale pressure vessel—a large, complex steel structure which houses the core of the reactor.

Use of the technique, the Westinghouse scientists say, will help speed pressure-vessel design and "insure that this vital structure can easily withstand any design pressures it may be called upon to contain."

The pressure vessels now being studied are those for power reactors of the "pressurized water" type. In a reactor of this type water is pumped through the pressure vessel, where it acts as moderator for the uranium fission process and also removes the vast quantities of heat the process releases.

To make this water hot enough to produce the superheated steam required by a ship engine or an electric power station, it must be kept in a sealed system under pressures as high as 2000 psi. Being part of the sealed system, the pressure vessel must withstand these pressures. However, it is a large, complex structure and the walls of the vessel and its head are pierced with many holes for control rods, water pipes, and the like. With such complications, it is extremely difficult to calculate all the various stresses which the high-pressure water creates in the walls and head of the vessel.

Now, for the first time, a technique for making these stresses visible is available.

The new method of examining the shell of a nuclear reactor uses a laboratory procedure called photoelastic stress analysis.

An exact model of the structure to be studied is constructed from a photoelastic resin, or plastic. Such resins have the ability to show visibly the twisting, bending, or other stresses they undergo when various forces are applied to them. When examined under polarized light, the stresses show up as patterns of colored light.

The plastic pressure-vessel model is about 2 ft high, $1\frac{1}{2}$ ft in diam, and about 100 lb in weight. After the model is cast, it is machined to exact shape. Air is then pumped into the model until it is under a pressure of about 4 psi—a pressure large enough to produce in the model the exact stress patterns existing in the actual pressure vessel under its working pressure of about 2000

These patterns of light being studied by M. M. Leven, research scientist at the Westinghouse Research Laboratories, show the stresses inside the "shell" of a power-producing nuclear reactor. The stresses are frozen into a plastic scale model of the reactor pressure vessel, from which slices are cut and examined under polarized light. This technique for the first time permits the photoelastic stress analysis of structures as complicated as a reactor pressure vessel, and will help speed nuclear-reactor design.

happen to go for this type of transport, a European car is probably your dish. Otherwise, you will get far more per dollar on almost every count if you buy American.

An interesting development is the "bubble on wheels." A tiny affair, it looks much like a soap bubble, usually operated by a 2-cylinder 2-cycle engine, with room inside for one or at the most two people. Other variations of this theme are the motorcycle with a fully enclosed body and a third or perhaps a fourth wheel added for stabilization.

Olivetti's typewriter and adding-machine plant at Ivrea is a good example of modern Italian industrial efficiency. An aggressive outfit, doing a world-wide business, Olivetti competes successfully in the U. S. market. Their labor is highly paid, too, by Italian standards—but just compare their labor rates with ours! Machinists, 41 to 51 cents per hour; highest skilled workers, a little over 55 cents per hour.

Nearby was the recently completed Olivetti machine-tool plant. This fine 100,000-sq-ft factory was built at a cost of about $1.30 per sq ft, including cranes, plumbing, heat, and light. At home, I am sure it would have cost $10 to $12 a foot. Olivetti and likewise FIAT got into the machine-tool business largely as a side line through having originally designed and built machines for their own use. In Italy, Olivetti is regarded as something of a radical pioneer in industrial practices. Recently, to use their own phrase, they "have gone to the American week end," shutting down Saturdays and Sundays, working five 8-hour days or 40 hours a week, as we do. This is a startling innovation in Italy. FIAT has followed it, but most plants work 44 hours or more, including half or a full day on Saturday.

The southern part of Italy is unimportant industrially, except perhaps for Socony Vacuum's oil refinery at Naples, which is a model of its type.

Random Impressions of Other Countries Visited

At their best, the French are among the world's finest engineers, technicians, and manufacturers. Some of their equipment is excellent. Many of their plants are modern and efficient. However, I should rate them far below the Germans, the Swiss, and the Scandinavians in industrial efficiency.

A side trip to Ireland, such as we made, would convince anybody that Eire has no industry to speak of and is making little effort to build one. She possesses few natural resources. Even her agriculture, except for livestock, is so underdeveloped that the de Valera government found it necessary to enforce increased tillage and cultivation of crops as the price of continued land tenure.

Her people, having won their independence, are deserting their cherished land of freedom in droves for countries richer in economic opportunity, notably the United States. The population has shrunk to some four and a half or five million from an erstwhile six or seven. Ireland's economy, in brief, appears in many respects to be an economic "can't be done," and one wonders what the ultimate outcome will be. It is to be hoped that these carefree, warm-hearted people, who have contributed so much to the progress of the free world in countless fields of endeavor, will somehow work out a sound and happy destiny for their beloved republic.

Greece has little to engage the mechanical engineer's technical interest, but to the civil engineer, the architect, the student of ancient history, a visit to Athens and its environs is a rewarding one indeed.

The American in Turkey finds himself in a strange and unfamiliar world of mosques and minarets and palaces which look like freshly frosted wedding cakes. Economically, Turkey's battle against inflation, in which she has to date come out second best, is a race against time, involving a long-shot gamble which begins to look as if it might pay off. Oil has been discovered in eastern Turkey, north of the fabulous fields of Iraq and Iran. The new strike may prove to be a liquid Eldorado; if so, Turkish fiscal problems will largely be solved. In the meantime, much of Turkish industry and business totters on the brink of bankruptcy. If she can lick her fiscal problems and find capital to develop her industrial potential, modernize her agriculture, and exploit her rich store of minerals, she will become one of the strongest of our allies.

Austria, with rich reserves of oil and perhaps the world's finest iron ore as a bulwark for her industry, is regaining a postion of importance in world trade.

Summary

What were my major over-all impressions and my net conclusions from this two months' sojourn? I have tried to set them down, and here they are:

1 A discouraging feeling that despite the billions which we have poured into foreign aid during the past ten years, Americans are more unpopular than ever in most of western Europe. Perhaps it is just the price we pay for our unwelcome position of world leadership and our high standard of living, which is unprecedented in world history.

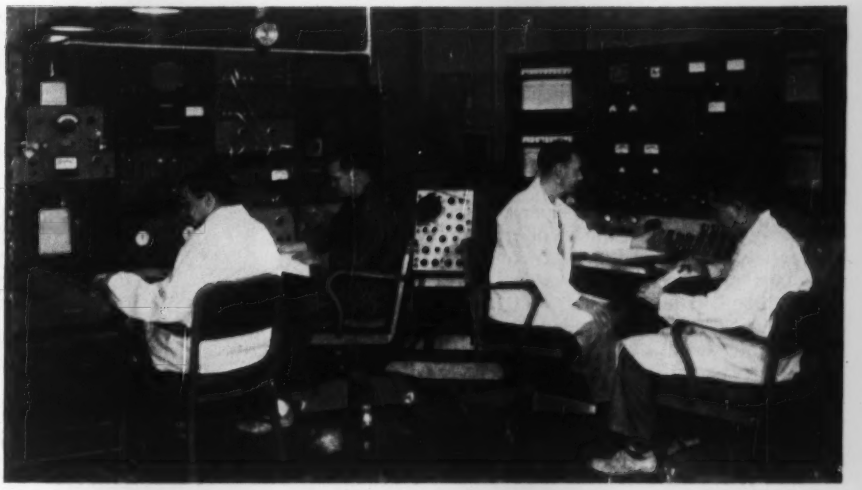
2 A conviction that we are in for severe price competition from western Europe in the U. S. domestic market. The spread between average labor rates in Europe and the United States is wider than it was at the war's end. Europe is not yet as efficient as we, but with labor rates averaging a third to a quarter of ours, she can still undersell us by more than enough to hurdle our modest tariff wall.

3 Few people, at home or abroad, realize that U. S. tariffs are now the lowest of any major trading nation in the world.

4 A conviction that free convertibility of currency between the sterling areas and the United States will probably not be achieved within the lifetime of most of us.

5 On the technical side, the impression that U. S. machinery and equipment are still superior in productivity, ruggedness, life, and precision to most of their counterparts in Europe. Our edge is narrow, however, and in selected areas we run second best. But the United States has virtually lost the European market in so far as general-purpose machine tools are concerned. The Swiss will not, and the other nations cannot, pay our prices. So long as we have prosperity at home, this condition will not bother us much, but give us a year or two of depression and it could really hurt!

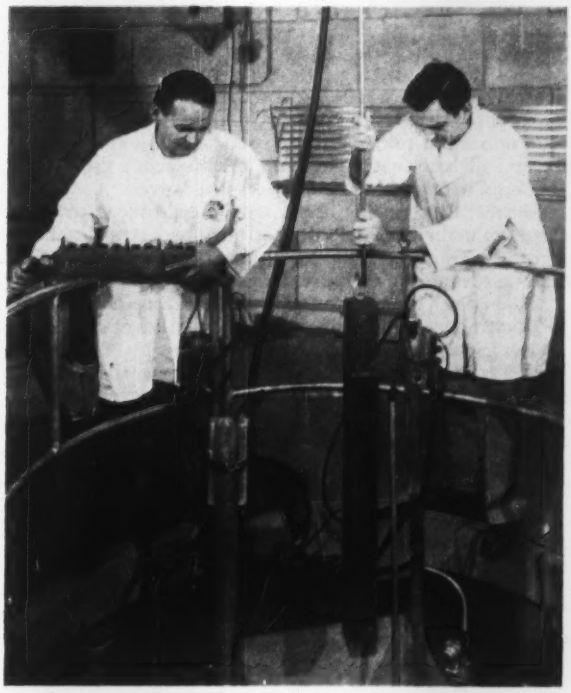
6 I do not believe that the Western alliance is breaking up, although it cracks at the seams most of the time. Our allies waver between exasperation over our foreign policy and envy of our good fortune. I get the impression, however, that they know a good thing when they have it; that they are not going to desert Uncle Sam for the dubious alternative of the Russian Bear's bosom.



In the control room of the Argonne National Laboratory's new experimental Zero Power Reactor No. 5 (ZPR-V), George Fischer, *2nd from right,* operates the reactor while Charles Cohen, *left,* Richard Withers, *2nd from left,* and Bert Toppel, *right,* record data from the meters of sensitive instruments located within the reactor.

Station in Idaho. ZPR-IV was a small neutron-source reactor built at the Laboratory's DuPage County, Ill., site. Work on all experimental reactors, except ZPR-III, has been completed and the assemblies dismantled to make room for more advanced studies.

This new reactor is one of the latest steps taken for the Atomic Energy Commission by the Argonne National Laboratory in the conception and development of nuclear power plants which will be competitive with conventional power stations.



A fuel element, containing uranium and other materials, is being lowered into the fast region of the new two-region nuclear reactor, ZPR-V. Frederick Beyer, *left,* is operating the crane as Frederick H. Martens guides the element into place. The ZPR-V (Zero Power Reactor No. 5) is a part thermal, part fast nuclear reactor built at the Argonne National Laboratory to provide basic information that will help scientists and engineers design more efficient and more powerful atomic power plants.

Nuclear Briefs . . .

Heavy-Water Power Reactor Study

A DESIGN study and development work to determine the feasibility and economics of heavy-water moderated reactors for electric power generation will be undertaken for the Atomic Energy Commission by E. I. du Pont de Nemours and Company. The study will pay particular attention to the utilization of natural uranium as fuel.

The work will be performed under the existing contract between the du Pont Company and the Commission for the operation of the AEC's Savannah River Plant in South Carolina.

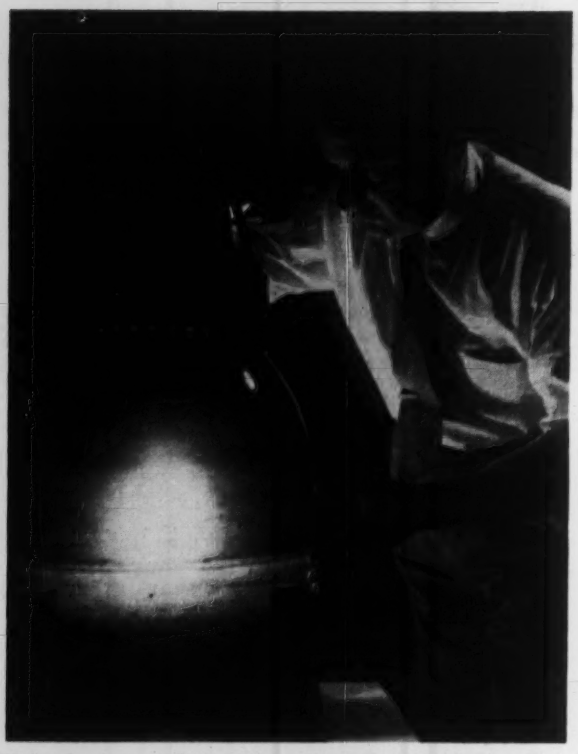
The study represents a further broadening of the scope of development work currently being undertaken by the Commission in its power-reactor development program. The Commission asked the du Pont Company to undertake the study because of the company's experience in the development, design, and operation of the Savannah River production reactors in which heavy water is used as the moderator and primary coolant.

The Commission-du Pont agreement makes no commitment for construction of a power reactor.

Experimental Breeder Reactor II

Argonne National Laboratory, operated for the United States Atomic Energy Commission by the University of Chicago, recently announced that the H. K. Ferguson Company of Cleveland, Ohio, has been selected as architect-engineer for the design of the Experimental Breeder Reactor II, which has been authorized as part of the Commission's five-year program for the development of competitive electric power from nuclear energy.

The sodium-cooled EBR-II will be built at the National Reactor Testing Station and will be designed to produce 62,500 kw of heat and 20,000 kw of electricity.



This glowing model enables scientists at Westinghouse to study the stresses deep inside the pressure vessel, or shell, of a full-scale nuclear reactor. Built to exact scale, the model is constructed of a special plastic into which stresses corresponding to those in the real reactor are frozen.

psi. The model is then cured by heating, which "freezes" the stress patterns permanently into the walls of the model. Samples are then cut from the model and examined under polarized light. The "frozen" stresses can then be studied rapidly and with great precision.

This is said to be the first time that photoelastic stress analysis has been applied on the scale required for study of a reactor pressure vessel. It is possible only because of the recent discovery of a new improved photoelastic resin. Compared to previous materials, this new resin is three times more "sensitive" in forming the desired stress patterns.

The new resin also makes it possible to prepare much larger models than before. A structure as complicated as a pressure vessel can be duplicated for photoelastic analysis only by taking full advantage of this increase in model size.

The success with current Westinghouse studies indicates that the technique will soon be applied to many structures equally complicated and difficult to analyze by other means.

Experimental Nuclear Reactor

A NEW experimental nuclear reactor of revolutionary design has been constructed and placed into operation by scientists and engineers at Argonne National Laboratory, an Atomic Energy Commission facility. Known as a "slow-fast" reactor, it is not designed to produce electric power but will be used to facilitate studies of the fundamental principles upon which future large power reactors may be designed and constructed.

Conceived, designed, and constructed by members of the Laboratory's Reactor Engineering Division, the new reactor is a zero-power reactor and is designated as Zero Power Reactor No. V (ZPR-V). Unlike many other power producing machines, a reactor can operate at extremely low power with exactly the same behavior and operating characteristics as it would have at a much higher operating power. Consequently, the important nuclear data needed for the development of full-scale reactors can be obtained by using a zero-power reactor which is less expensive to construct and more convenient to operate. In addition, the fuel and control-rod arrangements within the reactor can easily and quickly be changed so that many designs and ideas can be studied.

ZPR-V is, in a sense, a reactor within a reactor. The entire unit consists of a 5-ft-diam steel tank in which the uranium fuel assemblies and the control rods are placed. In the center of this tank is the "fast" reactor section which contains 49 enriched uranium fuel assemblies which are placed in a 2-ft square section. Surrounding this fast reactor section is the "slow" reactor section which consists of normal and enriched uranium fuel elements arranged in a geometric pattern around the fast core section and immersed in water. The new reactor is quite unique in that the nuclear chain reaction takes place in both regions although they have entirely different nuclear properties.

The two-region reactor utilizes the best feature of thermal and fast reactors—the safety and ease of control of a thermal reactor, and the superior nuclear properties of a fast reactor. By connecting these two systems together, it now becomes possible to study the nuclear physics of fast reactors without acquiring the control difficulties associated with this reactor type.

The nuclear reaction is started in the slow or thermal reactor section. Neutrons, created in the fission process, pass through the steel wall into the fast reactor section where they cause fission in the enriched uranium. A nuclear chain reaction cannot be established or maintained in the fast section unless it is maintained in the slow or thermal section. The fast reactor is much more difficult to control than is the thermal reactor. By making the fast reactor section dependent upon neutrons from the slow reactor section, it is possible to control the fast section simply by moving a number of cadmium or boron control plates located in the slow section. By inserting these into the thermal section, the chain reaction in the slow or thermal area is instantly stopped. Since no neutrons are then generated, the chain reaction in the so-called fast area is terminated.

In the earlier work at Argonne National Laboratory, a total of four zero-power reactors had been built and tested. The first of these, ZPR-I, was placed into operation on Oct. 4, 1950 and contributed valuable nuclear data and was used to determine the final core design specifications for the nuclear reactor for the atomic submarine, USS Nautilus. It thus became the first operating reactor of a type to be later used for propulsion purposes. The second (ZPR-II) was a prototype of the large production reactors designed by Argonne and du Pont Company scientists for the Savannah River Plant. ZPR-III is a fast reactor built and operated by the Laboratory at the AEC's National Reactor Testing

Essentially a two-phase (alpha-beta) alloy, it is nominally composed of 75 per cent copper, plus 8 per cent aluminum, 2 per cent nickel, and 3 per cent iron, in addition to the manganese.

The new alloy is said to surpass today's commercial bronze alloys in mechanical properties. It possesses higher yield strength, greater toughness (Izod notched impact strength is 18 to 30 ft lb), and longer fatigue life than any known alloy of its kind.

Whitish gold in color, this unusual alloy melts at a lower temperature (1814 F), casts better, and can be readily forged, rolled, or extruded.

Its improved castability gives it an outstanding advantage over conventional aluminum bronzes, which foundrymen generally consider difficult to cast. When making castings, thin vanes, for example, flow readily. Even for heavy sections, the feeding and solidification characteristics assure absolute soundness in the finished casting.

Besides being easy to cast, Superston 40 offers the added strength, lighter weight, and longer life sought by designers.

Sintering

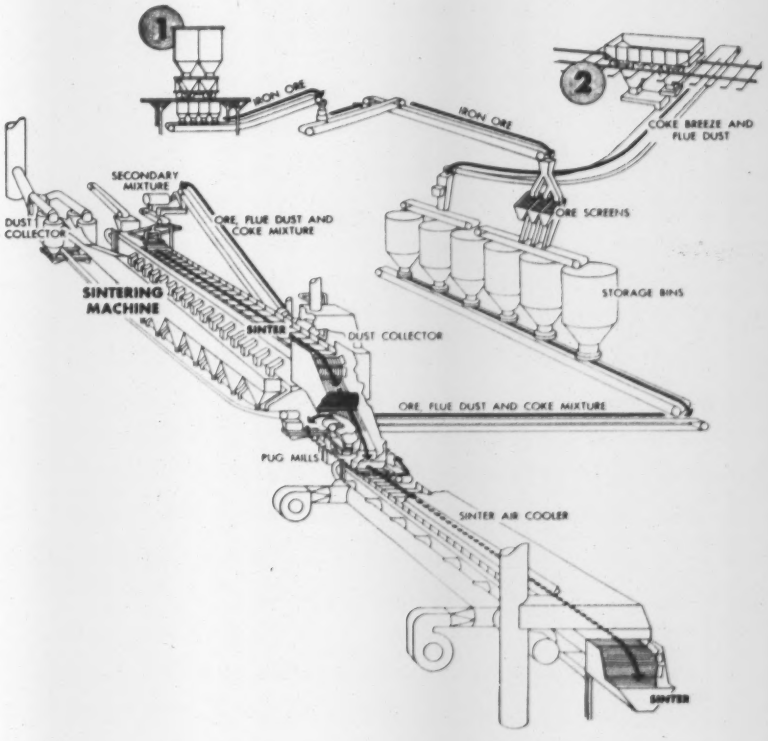
SINTERING—a process that makes fine iron-ore particles and flue dust, which might otherwise be wasted, into compact lumps—is rapidly growing, according to *Steel Facts*, October, 1956. Sintering facilities for the iron and steel industry are being expanded more rapidly than ever before, a leading engineer in the field pointed out. Eighteen new sintering machines, with a total annual capacity of over 25 million net tons, are scheduled for completion before the end of 1957. Added to the 103 machines of all kinds now operating, the new facilities will bring national sintering capacity to an estimated 63 million net tons per year, the authority states.

Some veteran blast-furnace men used to consider sintering as "a reasonably convenient, but somewhat troublesome means of utilizing waste products, the disposal of which constituted a bit of a nuisance." Today, many advantages are recognized in using sinter in iron and steel manufacture.

A few iron ores are too soft for efficient use as they come from the ground but can be sintered into compact lumps for a good furnace charge. The process is also used for improving the consistency of fines from ore, beneficiating and preparing for re-use the iron-bearing flue dust recovered in blast-furnace operations. Experience has shown that blast-furnace production often increases when sinter is used in the charge, and there is less coke consumption per ton of iron made.

All but ten of the 103 sintering machines now used in this country are of the "moving bed" type, manufactured by several companies. The simplified, schematic drawing below is not intended to show any specific machine, but gives a visual impression of the operation and some of the equipment.

Fine ore, flue dust, and fine coke (called coke breeze) are stored in bins. Measured amounts of those materials are carried on belt lines to pug mills, where they are mixed before going to the head of the sintering machine. A layer of mixed ore, flue dust, and coke breeze is spread on the moving bed of the machine. Then the coke breeze is ignited by passing under flames. The burning



This simplified schematic sketch of one of several types of sintering machines is not drawn to scale. Several auxiliary facilities are omitted. The purpose of the illustration is solely to convey an impression of how fine iron-bearing materials are sintered to make a desirable furnace charge. It is not intended to represent an actual machine. Start reading at numerals at top.

Supercomputer

THE U. S. Atomic Energy Commission and International Business Machines Corporation announced signing of a contract under which IBM will begin developing STRETCH, a general purpose supercomputer, for installation at Los Alamos Scientific Laboratory.

The precise mathematical functions required of the machine will be determined by a group of scientists of IBM and of the Los Alamos Scientific Laboratory, which is operated for the Atomic Energy Commission by the University of California. The study group is engaging now in a mathematical survey to define the nature of the problems the computer will encounter and the mathematical functions needed to solve them.

Recommendations of the group will enable IBM logical design specialists to set up precise specifications for the machine as work progresses and to insure that the calculator's component functions will be in line with actual requirements.

General performance specifications for STRETCH outlined in the contract would make it between 100 and 200 times faster than any comparable general-purpose calculator available today, and also would permit it to solve problems of much greater scope and complexity.

The designation STRETCH was selected for the endeavor to symbolize the technological advances which will be represented by the development of the most advanced computer possible in the shortest period of time.

Refueling Boiling-Water Reactors

Procedures and equipment for refueling large boiling-water reactors will be developed and proved in a new facility at the General Electric Company's Atomic Power Equipment Department in San Jose, Calif.

The new test facility was designed specifically for developing refueling procedures of the 180,000-kw Commonwealth Edison Dresden nuclear power station which General Electric will construct near Chicago. It also will be suitable for use with other boiling-water type reactors.

The new facility will be housed in a structural steel tower 86 ft high. Main component of the facility is an all-welded 14-ton steel tank, 56 ft high × 8 ft in diam, which will simulate the pressure vessel of a large boiling-water reactor. A reactor core mock-up will be installed in the tank, which will then be filled with water.

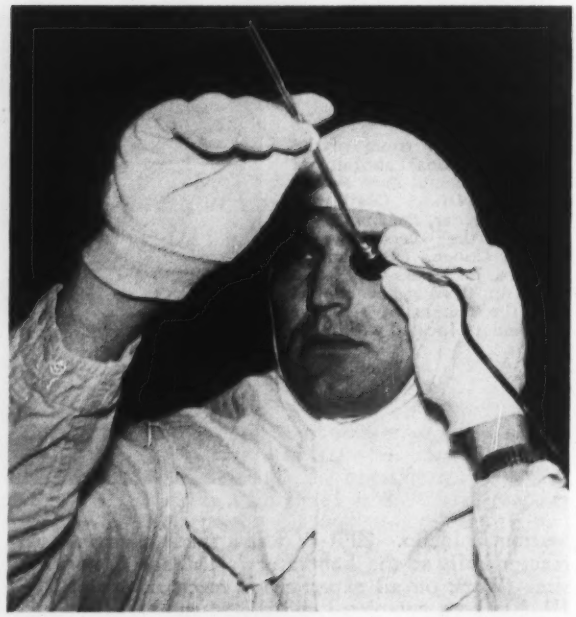
Technicians operating the facility will work from a platform above the tank, using crane-supported, long-handled grappling hooks to insert simulated nuclear fuel bundles in the "reactor core" 40 ft below the surface of the water.

"Sneaky Peeky"

MANY years ago Ezra Hollister, Mem. ASME, a mechanical engineer in the General Electric design section of the Hanford Atomic Plant, taught at a missionary school in China where he frequently visited the school hospital as part of his duties.

His interest in medicine, while at the school, recently resulted in the employment of a delicate medical instrument to solve a tough engineering problem at Hanford.

When fellow engineers had trouble assuring the fit of gaskets inside a fitting, Mr. Hollister recalled that the doctors in China used a cystoscope to look into almost inaccessible parts of the body.



A General Electric Company employee at the Hanford Atomic Plant looks through a physician's cystoscope used at Hanford for inspecting hard-to-see parts beyond the reach of conventional optical instruments

A midnight phone call to the hospital at Richland located such an instrument and an emergency problem of checking fittings in close quarters was solved.

General Electric engineers put the cystoscope to work for double checking of connections, inspecting fuel elements, examining reactor apertures, and many similar tasks made vexing by limited access.

Called the "sneaky peeky" by the Hanford engineers, the cystoscope can be fitted into a small area while the operator peers through its magnifying eyepiece. Illumination is from a tiny electric lamp no larger than a grain of wheat. To see around corners the cystoscope is fitted out with a system of tiny mirrors.

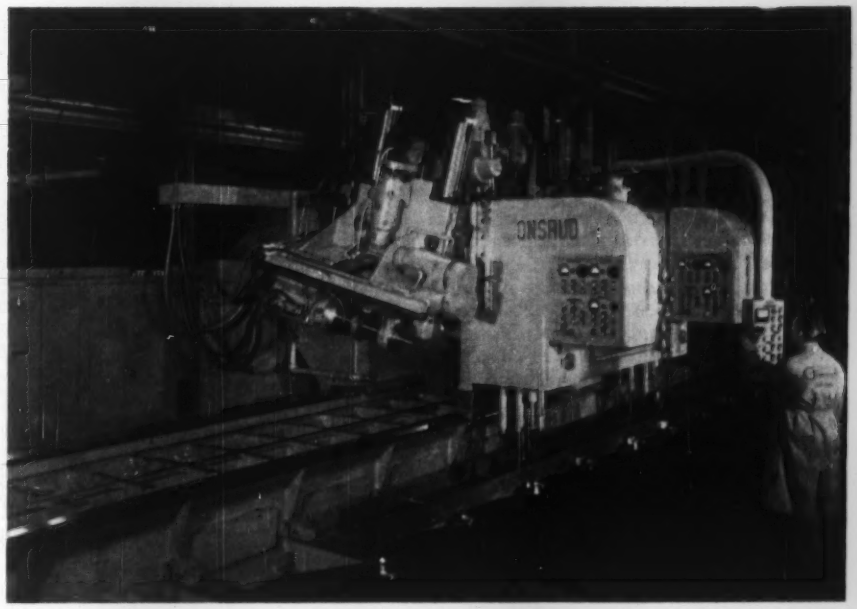
When needed, photographs also can be made through the device, General Electric engineers report.

Aluminum-Bronze Alloy

HIGH mechanical properties and superior casting characteristics are combined in a new high-strength aluminum-bronze alloy that will be produced for the first time in the United States by American Brake Shoe Company, New York, N.Y., and Ampco Metal, Inc., Milwaukee, Wis.

Brake Shoe and Ampco have joined with J. Stone & Company (Holdings), Ltd., of London, the British firm that first developed the new alloy, to form a new company, Superston Corporation, which will introduce the alloy here. It will be known as Superston 40.

Superston 40 is unique in that, unlike any present bronze alloy, it contains about 12 per cent manganese.



This closeup shows two of the four General Electric operator control panels and a pendant station, part of the control equipment used to direct the complex milling operations of the Onsrud spar milling machine. Selsyn tracing heads can be seen following the template mounted parallel to the workbed and located along the base of the machine.

previously required several machines and several setups. Similar but smaller machines built recently by Onsrud and equipped with General Electric controls have been tested and proved in actual production where two machines did the work planned for four machines, thereby providing a substantial saving in production time and floor space.

The control system is based on the principle of selsyn control. On the linear feed motions, each 400-cycle General Electric selsyn is connected so that it makes one revolution for each half inch of motion. A corresponding selsyn is connected to rotate in relation to a follower which traces the configuration of lineal cams or templates—which need be no more than one eighth of an inch thick—mounted parallel to the working surface and located near the base of the machine. As the template height changes, the selsyn connected to the follower head rotates at one revolution per half inch of change. By connecting the template follower and feed-drive selsyns, an error signal proportional to the difference in the angular position of the two selsyns is obtained. Since one selsyn is connected to the cutting head and the other is following the template which is to be duplicated, the resulting signal provides a measure of the difference between the tool position and the template. The control uses this signal to direct a d-c drive motor and operate the feed motion to keep the tool in correspondence with the template, resulting in a cut corresponding to the configuration of the template.

Onsrud has conducted exhaustive tests on the machine and control, checking on repeat cut operations, depth of cut capabilities and general performance characteristics. Test results indicate that the new machine is capable of providing repeat cuts to accuracies of 0.002 in. at production rates as high as 300-ipm carriage feed and 30-ipm head feed. In addition, it was found that a one-inch depth of cut seven inches wide on rise and fall with changing transverse and twist motions can be made.

Missile Tester

RACE, an ultrarapid missile tester which enables highly mobile guided-missile troops to strike targets faster and more effectively, was demonstrated recently to Army officers in Washington, D. C., by Sperry Gyroscope Company.

The new device is the first to bring automation into tactical combat areas to test, trouble shoot, and service complex missile systems as they are emplaced at new launching sites.

Observers saw lights and screens flash decisive data while computer punch cards directing remedial actions ejected from a model console simulating full-scale action of the missile tester. Other versions of RACE (Rapid Automatic Checkout Equipment) will test complete supersonic-aircraft systems and fire-control systems aboard ships.

At the push of a button, RACE dynamically tests each missile unit, performing in minutes the hundreds of preflight tests that would consume vital hours by more conventional means. A master console employs lightning-fast computer elements to check out all units of the entire missile system, provide necessary maintenance, and supply critical information for command decision during final countdown.

Where trouble exists, RACE pinpoints the faulty component, flashes its location and replacement time on a console screen, and immediately delivers a computer punch card spotting the plug-in replacement for technicians.

RACE precludes false answers by testing itself continuously during the missile checkout and confirming all answers at the master console. If trouble does occur within RACE, it warns the operator immediately, naming exact rack, drawer, and chassis location of its own faulty plug-in component for immediate replacement.

Go-No-Go panel lights monitor rapid progress of

coke, aided by air sucked through the bed, begins to fuse together the surfaces of the ore and dust particles.

By the time the layer of materials reaches the end of the sintering machine, it is caked almost solid. Rotating steel sinter-breakers "chew" the cake into fairly uniform lumps, which then fall onto the bed of a sinter cooler. The lumps are recovered for use in blast furnaces.

Alumina From Clay

After nearly two years of laboratory and test plant work the Anaconda Company announced that it has solved the problem of producing alumina from clay located in the area of Moscow, Idaho. Company spokesmen stated that the alumina thus produced has been in substantial quantities and within the specifications required by it under its contracts for this material extracted from bauxite. Alumina is the substance from which aluminum is made. Heretofore it has been extracted from bauxite of which the principal sources of supply for the United States are the islands of the Caribbean. It has been known that alumina is also contained in commercial quantities in some of the clays of the United States.

Attempts had been made without success by the United States Bureau of Mines and other agencies for more than 25 years to solve the problem of extracting alumina from these domestic clays. The matter became particularly acute during the submarine campaign of World War II, and extensive work was done at that time as well as during the period of World War I in an attempt to free the United States from its dependence upon overseas sources of supply. It was not, however, until May of this year that a test plant that had been constructed by Anaconda in connection with its laboratories at Anaconda, Mont., was finally successful in producing a commercial grade of alumina. Now the company is in the process of designing and constructing a pilot plant of 50 tons per day capacity, from which it is expected a full-scale commercial plant will be developed with adequate capacity to furnish the company's total requirements for alumina on an economically competitive basis. It is anticipated that the design and construction of the pilot plant will require approximately one year, at a cost of slightly over one million dollars.

In anticipation of the success of its project, the company has already optioned vast reserves of clay in the Moscow, Idaho, area, which is within approximately 375 miles by railroad from its Montana aluminum plant. It is expected that when it is constructed the commercial plant will be located at the site of the clay deposits.

Electronically Controlled Milling Machine

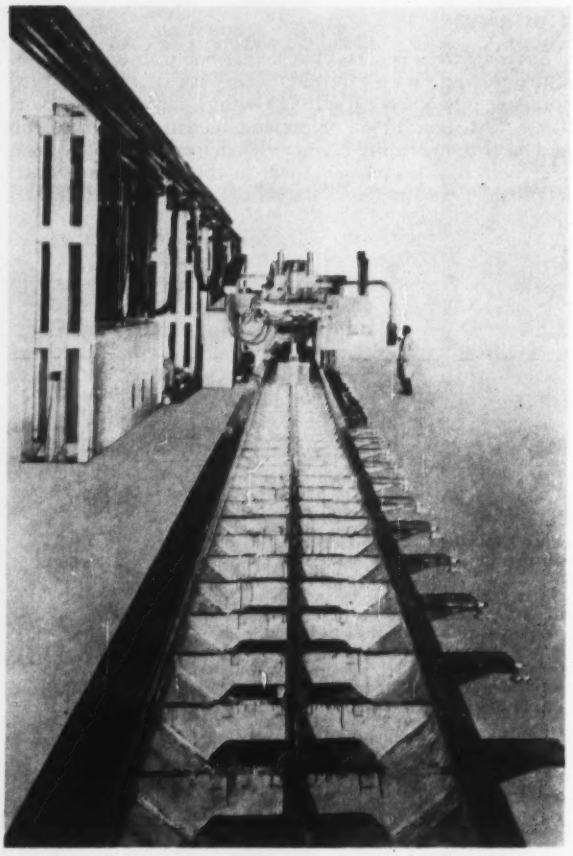
A precision-engineered electronic tracer-control system directs from one to 12 simultaneous or individual cutter-feed motions on a 90-ton universal spar milling machine, the first of 18 to be built by the Onsrud Machine Works, Inc., for the U. S. Air Force Air Materiel Command.

The machine, capable of performing more simultaneously controlled motions than any other machine now in existence, is designed for use in operations which cannot be accomplished by any means other than automatically controlled machine tools. It is a huge 84-ft machine and can mill spar beams and parts up to 60 ft long. A gantry-type carriage houses four cutter motors that together develop over 320 hp.

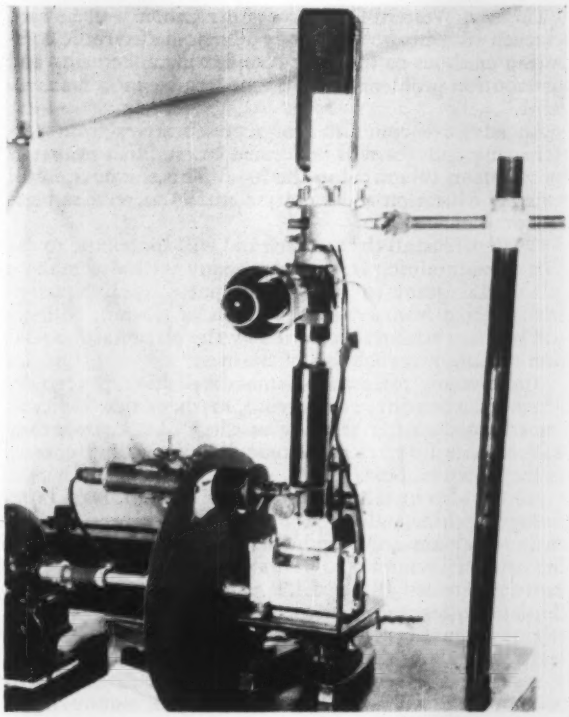
The machine is actually equipped with 12 tracer control systems integrated into a single machine control, believed to be the largest control of its type ever built. Each of the 12 systems employs a selsyn-type one-dimension tracer to direct a single machine feed. The integrated control system makes it possible to operate from one to 12 machine feeds simultaneously, automatically controlling the position of four spindles.

Since the application of the machine will be in the processing of spar and wing chords and wing skins requiring a wide variety of machine cuts, the control had to be engineered to provide simultaneous rise and fall, transverse, and twist motions. For this reason, the machine is normally set up with multipurpose tooling fixtures which allow almost complete machining of a part before it leaves the stationary workbed.

A primary advantage of the new control system is its capacity for directing a multitude of different cuts which



The world's first electronic tracer-controlled spar mill, the Onsrud A-90-24 Universal Contour Milling Machine. Bed length is 84 ft providing work area for parts up to 60 ft long × 35 in. wide. Four milling heads mounted on carriage are capable of a total of 12 different head motions, operating singly or in combination in addition to longitudinal feed by carriage travel.



Small fatigue-testing machine equipped with a motion picture camera for filming the microscopic features of metal fatigue at the National Bureau of Standards. The testing machine is set on the stage of a metallurgical microscope. The clock-controlled, 16-mm camera, set on top of the microscope, takes time-lapse motion pictures of aluminum specimens under torsional stress. An alternating torsional load is applied by cams mounted 180 deg out of phase on the motor-driven shaft.

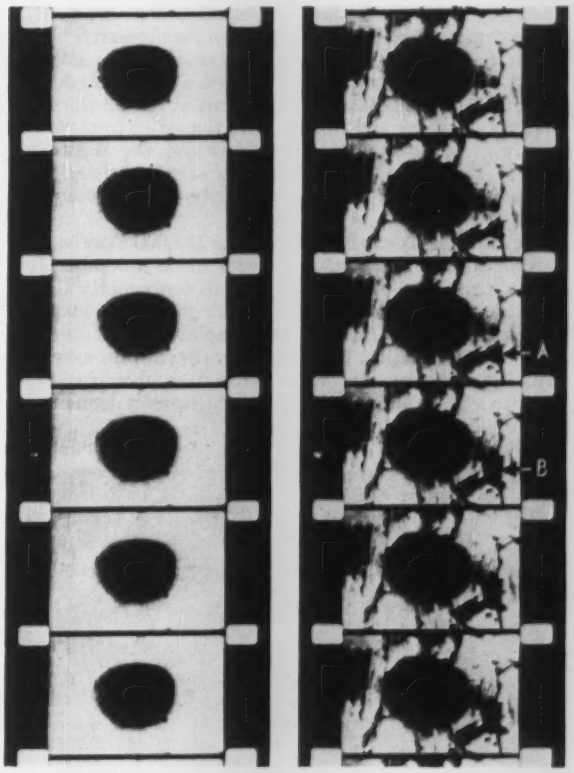
automatically recorded, detailed pictures of the fatigue process.

The base of the fatigue-testing machine is a block of steel designed to fit the stage of a metallurgical microscope. The base is machined at the top to a shallow U-shape, and a horizontal collet for holding the test specimen is inserted through the upper parts of the block. Two small eccentric cams are mounted at the ends of a motor-driven shaft passing through the lower part of the base so that cam followers can transmit the load to the ends of the collet above. The metal specimen to be filmed is pressed into the collet, and an alternating torsional load is applied through the cam followers by the cams, which are mounted 180 deg out of phase. The amount of load is determined by the degree of cam eccentricity. A 0.01-in. hole, drilled in the top surface of the specimen, provides a focusing target for the microscope. Any fatigue failure that occurs will tend to develop around the hole and thus be in the field of the microscope.

The camera is attached to the principal eyepiece of the microscope while a second eyepiece permits simultaneous visual observation. A large disk with a hole near its edge revolves on the motor shaft and serves as a shutter by interrupting the light to the microscope's vertical illuminator. This arrangement permits successive exposures at the same point of the stress cycle. It is necessary because each frame may be exposed a number of times before another takes its place.

The film is advanced at regular intervals by a synchronous motor-driven cam that actuates the camera's single-frame button, the camera shutter being adjusted to close only during film transport. Since the speed of the fatigue machine can be adjusted with respect to the movement of the film, the number of stress cycles per frame can be varied depending on how rapidly changes are taking place in the metal surface.

Portions of the films taken during the early stages of the fatigue test showed no unexpected changes. Slip bands developed in the highly stressed regions around the hole, and these gradually became more numerous and heavier until some of them developed into cracks. During the latter stages of the test a crack developed in an area that had contained no slip bands in the early part of the test. A short time later, material began to be extruded from this opening at irregular intervals but in surprisingly large quantities considering the size of the crack. Since the crack was only 0.01 in. long and the extruded ribbon very thin, the actual amount of material driven out was extremely small. This phenomenon



Frames, *left*, from NBS motion picture showing the early stages of aluminum under torsional stress. Slip bands have developed in the highly stressed regions around a 0.01-in. hole that had been drilled in the metal surface. Frames, *right*, of the latter stages of aluminum under torsional stress. Some of the slip bands have developed into cracks, and a material of unknown composition is being extruded from the crack at irregular intervals. Note difference in amount of dark material at A and B. Each frame was exposed for approximately 25 cycles of stress.

RACE's thorough tests through the entire missile system, including guidance and tracking radars, firing controls, plus missiles on several launchers. At completion of checkout, RACE gives a "GO" signal for the firing station.

Bearing and Lubricant Center

A NEW $1,000,000 bearing and lubricant center, said to be the largest test and development facility of its kind in American industry, was opened recently by the General Electric Company, Schenectady, N.Y.

Dr. Robert O. Fehr, manager of mechanical engineering for the company's General Engineering Laboratory, said the new center is equipped to carry on advanced development work relating to atomic submarines, jet engines, missiles, and satellites, and "constant improvements in turbines, motors, and household appliances."

Dr. Fehr predicted that "new concepts" in bearings and lubricants would bring about the "breakthrough" needed to meet the demands of the Space Age.

He envisioned "dramatic technological changes" necessary to cope with the "fantastically high speeds and high temperatures of the future—speeds up to 25 times the speed of sound and temperatures around 1000 F."

Some of the revolutionary concepts being studied by forward-looking engineers, he said, are air bearings which greatly minimize or eliminate friction, and the use of molten metals and molten glass as supersonic lubricants.

Engineers also are exploring new concepts of balanced gravitational and centrifugal forces, Dr. Fehr said.

The new center combines in one location General Electric's bearings and lubricants development facilities formerly divided between the Thomson Laboratory of the Lynn, Mass., River Works and the General Engineering Laboratory here.

The combined facility has a staff of 30, including 14 engineers, and is expected to double its personnel "in the next few years," Dr. Fehr said. It is able to draw on the extensive facilities of the parent General Engineering Laboratory and its 1300 people, he added.

The center will conduct broad research engineering programs. In addition, it will supply consulting service and will carry on high advanced development and application projects for the company's product departments. It will also assist in setting standards and specifications for bearing materials and lubricants.

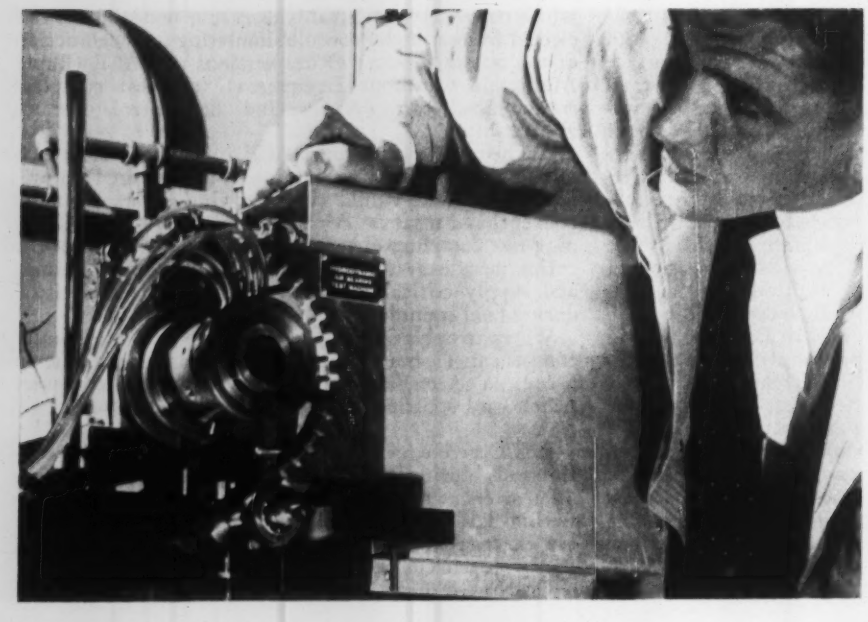
Engineers and scientists in this activity will be concerned with all types of bearings and with problems in closely related areas of technology.

Lubrication work will include investigations and development of oils, greases, synthetic lubricants, and solid lubricants. Much of this work will be on a cooperative basis with other organizations. In addition, work will be conducted on systems for lubricating bearings.

Motion Pictures of Metal Fatigue

THE National Bureau of Standards has recently constructed a small fatigue-testing machine equipped with a motion picture camera for filming the microscopic features of a metal surface during fatigue fracture. The apparatus uses a clock-controlled, 16-mm camera to take time-lapse motion pictures of aluminum specimens under torsional stress.

An understanding of fatigue phenomena is important to the engineer in predicting the life of a metal in service and to the metallurgist in designing more fatigue-resistant metals. In order to obtain detailed information on fatigue for use in aircraft design, the National Advisory Committee for Aeronautics is sponsoring a Bureau study of the basic factors influencing fatigue crack initiation. The films made in the course of this investigation should simplify tedious laboratory determinations by providing



Engineer Gerry Fox runs a high-temperature test on a new hydrodynamic air bearing in General Electric's new million-dollar Bearing and Lubricant Center. The facility is part of the company's General Engineering Laboratory, which has developed an air-lubricated bearing for special applications, such as extremely high temperatures, radioactive areas, or where extremely low friction is required.

IBM is also installing its type 650 Magnetic Drum Data Processing Machine, called the "medium-sized brain," in U. S. colleges and universities at reduced rentals. Eighteen 650 computers already have been installed, and 14 models are on order. The versatile 650, which rents for approximately $3500 a month, has done every kind of calculating job, from "sea testing" the atomic submarine *Seawolf* while it was still on the drawing boards, to figuring out "Rickey Ratings" of National League ballplayers.

Solar Furnace

ARTHUR D. LITTLE, INC., of Cambridge, Mass., has expanded its activities into the high-temperature field and is completing a solar furnace for such research. The staff has long been engaged in extreme low-temperature research and the production of equipment for work within 8 deg of the lowest temperature possible, and now they will also be working with temperatures of 3500 F.

Dr. Peter Glaser is in charge of the development of a solar furnace of significantly different design than existing units. The furnace will serve as a model for others to be offered to other research laboratories in 1957.

High-temperature investigations are important to nearly all fields of science. Advance in missile and nuclear technology will depend greatly upon discovery of materials that can withstand the high temperatures involved. Scientists know very little about the properties of materials at these temperatures, and much basic research must be done with equipment like the solar furnace, which permits a variety of observations to be made with ease. Since direct sunlight is needed only for relatively short periods of time to collect these data, the solar furnace will perform satisfactorily in any part of this country.

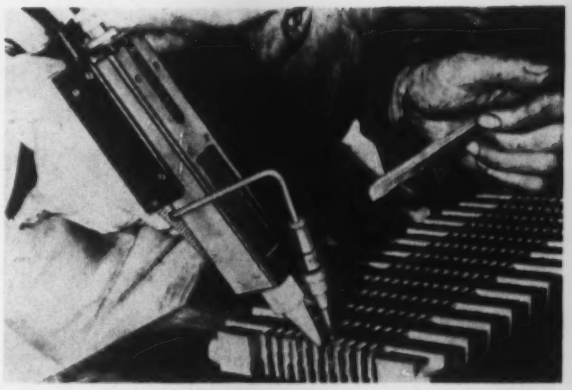
Dr. Glaser expects that the ADL solar furnace will help to open up the high-temperature field for research just as the development of the ADL Collins Helium Cryostat permitted scientists to study the behavior of matter at extreme low temperatures. Work at the upper end of the temperature scale promises results as important as those that have come from low-temperature research, according to Dr. Glaser.

Ultrasonic Soldering Iron

A LOW-COST ultrasonic iron, capable of soldering aluminum without flux by completely removing the oxide film on the metal surface, was introduced recently in the U. S. by Acoustica Associates, Inc., Glenwood Landing, L.I., N.Y.

The soldering iron, with its accompanying power unit, is made in England by Mullard, Ltd. Mullard has named Acoustica Associates the United States distributor of Mullard's ultrasonic equipment. Acoustica is known also as a leading American designer and manufacturer of ultrasonic systems for all industries.

The new ultrasonic soldering iron applies ultrasonic power, silent sound waves, through the molten solder to the surface of the aluminum or other light metal. A "cold-boiling" effect, called cavitation, is produced within the solder. The cavitation bubbles completely remove all oxide film from the metal surface allowing a wetting action by the solder, and thus tinning takes place. No flux is required.



Here an ultrasonic soldering iron is shown filling a blowhole in an aluminum casting. Acoustica's Mullard ultrasonic soldering equipment provides an efficient and convenient means of soldering aluminum and its alloys.

The soldering iron has a pistol grip and can be supplied with a choice of either a chisel-shaped or tapered copper bit. Power is supplied directly from the power unit.

Features of the soldering iron include its built-in bit-heating element, built-in servo stability system, no frequency drift, light weight of only two pounds, quiet operation, and ease of handling.

For rapid dipping of small articles, the iron can be replaced by a tinning bath which operates from the same power unit. The bath consists of a small solder pot $^{7}/_{8}$ in. in diam, $^{3}/_{4}$ in. deep, the ultrasonic vibrations being applied to the bottom of the pot.

Acoustica's ultrasonic soldering equipment enables strong, noncorroding bonds to be made on these metals with the ease of a normal soft soldering operation.

Applications of ultrasonic soldering include fabricating or altering aluminum patterns, filling of blowhole defects in aluminum and light alloy castings, bonding of aluminum cables, electrical and electronic assembly work, tabs for aluminum transformers, and sealing aluminum cases.

Acoustica Associates, Inc. will also distribute a low-cost Mullard ultrasonic drill for making odd-shaped holes in glass, ceramics, ferrites and other hard brittle materials.

"Delrin" Acetal Resin

A NEW plastic material, "Delrin" acetal resin, which has an unusual combination of mechanical properties, is being developed by the du Pont Company's Polychemicals Department.

According to the company, Delrin has an excellent combination of high tensile strength, toughness, high melting temperature, fatigue life, dimensional stability, solvent resistance, and resistance to deformation.

Laboratory and practical tests show Delrin to be suitable for a wide range of engineering applications which require a material able to retain its properties under conditions of high temperature and humidity, during an extended time under stress, or on exposure to most solvents.

occurred suddenly and was not observed until the film was developed and viewed, so that no attempt could be made to collect the extrusion for chemical analysis. However, it has been suggested that the extruded material, if not an oxide of some kind, is so fine that it probably reacts immediately with the atmosphere to form one.

University Computer Center

THE first university computer center devoted to the study of complicated business management problems will be established at the University of California at Los Angeles.

Called the Western Data Processing Center, it will be located on the UCLA campus but will be used by business researchers and students from colleges and universities in 11 western states. This project is a major step toward solving the growing shortage of business analysts schooled in the use of electronic computer

The new center was made possible by a multimillion-dollar gift from International Business Machines Corporation including the use of a 705 Electronic Data Processing Machine, a giant digital computer designed especially for business data and management problems.

The computer will be housed in its own research building, half the cost of which will be contributed by IBM.

The new center is part of a program to establish two major computing centers of different types at the University's Berkeley and Los Angeles campuses to serve the rapidly growing needs of California and the West generally. The Berkeley center—heart of which is an IBM 701 computer—will be devoted chiefly to scientific problems.

The IBM 705 is capable of making 240,000 "decisions" in terms of true and false answers in 60 seconds. Engineered to handle business data, it can rapidly distill millions of figure-facts to determine the prime location for a retail store; simulate the complete operation of an oil refinery; handle a huge billing operation in minutes; furnish inventory and production-control reports; or make up a 50,000-man payroll with millions of deductions.

The new Western Data Processing Center will be used to teach students how to apply advanced electronic computing methods to the most complex manufacturing and distribution problems faced by modern business management.

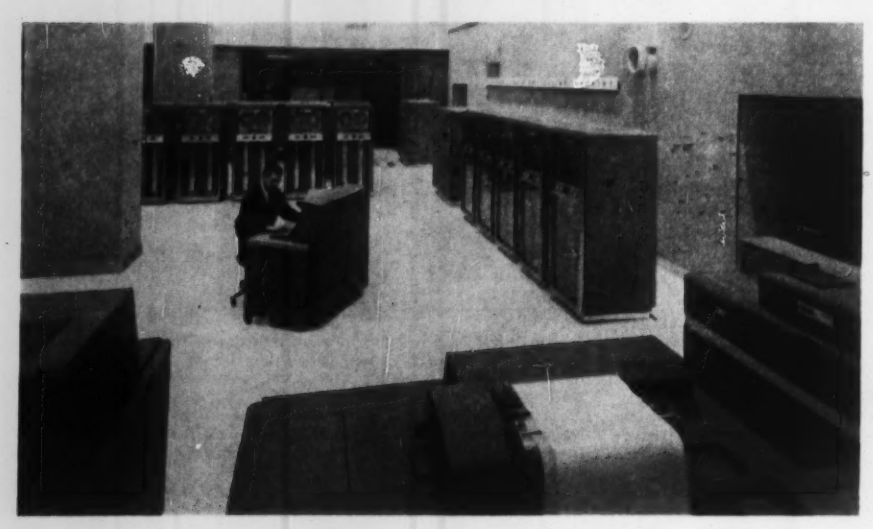
An advisory committee of representatives from participating colleges will be formed to establish priorities for problems submitted to the 705. This committee will consider education and scientific studies as well as business problems.

IBM will install the machine and will contribute to the cost of maintaining it. The company will also make a substantial grant to support computer research assistants selected from graduate schools of western colleges and business schools accredited by the National Association of Collegiate Schools of Business.

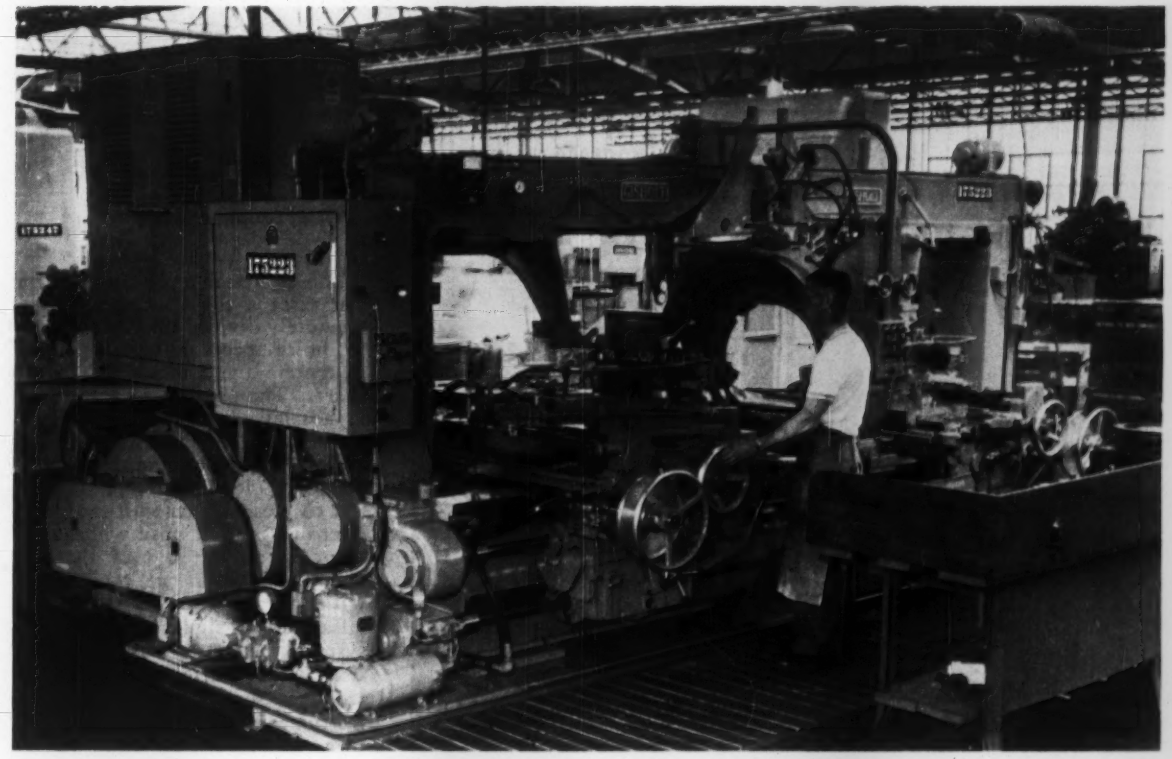
These young research assistants will have college degrees in accounting, engineering, mathematics, logic, or the sciences. After training at the UCLA center, they will be able to teach electronic-data-processing courses at their own schools.

IBM is also installing a type 704 Electronic Data Processing Machine, which is designed for processing scientific and research problems, at the Massachusetts Institute of Technology. This program is a co-operative venture between IBM, M.I.T., and at least 23 other New England colleges, to increase the number of scientists and engineers qualified to use large-scale computers, and to learn more about their application to research problems.

Students and teachers throughout New England will bring to the IBM 704 problems which require high-speed computation facilities. The fields for which the computer is expected to find use are "operations research," the application of new data-processing methods to complex manufacturing and distribution problems; aerodynamics, where computations will lead to a better understanding of shock waves at transonic and supersonic speed; meteorology, where rapid assimilation of weather data can lead to better forecasting; atomic research, where calculations can throw new light on subatomic particles; and solid-state physics, in which efforts are being made to find even more efficient components for computers.



Shown here is the IBM 705 Electronic Data Processing Machine which will be installed at the UCLA Computer Center devoted to the study of complicated business-management problems. The machine is capable of making 240,000 decisions in terms of true and false answers in 60 seconds. Engineered to handle business data, it can rapidly distill millions of figure-facts to determine the prime location for a retail store; simulate the complete operation of an oil refinery; handle a huge billing operation in minutes; furnish inventory and production-control reports; or make up a 50,000-man payroll with millions of deductions.



Center-Drive Lathe. This newly developed center-drive lathe has decreased the time necessary for machining a jet compressor disk from 281 min to 181 min at Pratt & Whitney Aircraft, East Hartford, Conn. The machine has also enabled production workers to lop a half hour of the time required to machine a jet-turbine disk. In addition to the time savings, the new machine operates to a finer degree of accuracy than previously attained for these parts. Designed by Pratt & Whitney and constructed by Gisholt Machine Company, the machine's ability to cut on both sides of the disk simultaneously contributes to the accuracy of the work. By balancing the pressure on each side the operator can be assured of a flat part. A tracer-type lathe, one which is guided by a tracing ten plate, it can follow a wide variety of complex contours. Because of its success 28 more have been ordered from the Gisholt Machine Company.

Aluminum Heat Exchangers. This all-aluminum heat exchanger is one of two manufactured by The Griscom-Russell Company, Massillon, Ohio, for a development and test program on propellants for rocket motors being conducted by Reaction Motors, Inc., Denville, N. J. Liquid nitrogen will be vaporized in the shell side of the shell-and-tube unit at −320 F in order to cool liquid oxygen passing through the tubes at approximately −285 F. The shell has an ID of 32 in. and the tubes are 3/8 in. OD. Aluminum was used throughout for these units because of its high Charpy impact values at such low temperatures. Plain or mill steel was out of the question because at −320 F it would be extremely brittle under impact. Design operating pressures are 50 psi on the shell side and 150 psi on the tube side; the design temperature range is ±100 F to −325 F.

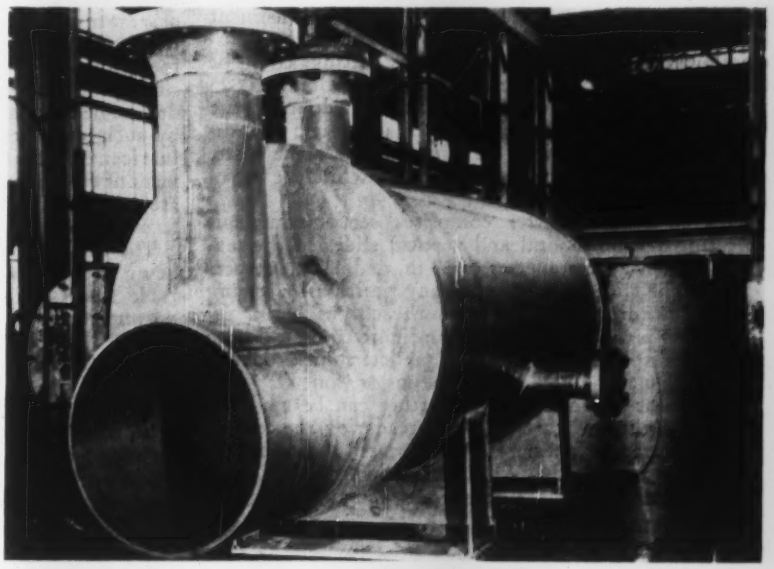


Photo Briefs

Satellite Launching. Artist's conception shows the firing and launching platform for the earth's first artificial satellite which has been designed, built, and installed by the Loewy-Hydropress Division of the Baldwin-Lima-Hamilton Corporation, New York, N. Y. Under Project Vanguard, which is being directed by the Office of Naval Research, the platform will be used for testing and firing the huge three-stage rocket which will attempt to place the satellite in its orbit around the earth. This is in support of U. S. participation in the International Geophysical Year, 1957-1958. The Martin Company, Baltimore, Md., is prime contractor for the three-stage rocket. Vapor blast at *right* of picture is stream of exhaust gases. In background is gantry used to place the rocket on the platform. The launching site is the Air Force Missile Test Center, Cocoa, Fla. Under its subcontract with Martin, Lowey-Hydropress will also be in charge of complete stand instrumentation, support stand mechanisms, as well as utilities and preliminary research—such as heat stress analysis.

Self-Dumping Hoppers. All bulk materials handling at North Chicago Refiners & Smelters, Inc., North Chicago, Ill., is accomplished with self-dumping hoppers transported by fork-lift trucks. Scrap used in making brass and bronze ingots, copper anodes, zinc die castings, and other alloys, received in rail cars or trucks, is unloaded into Roura hoppers and carted to segregated storage bins. Hoppers are also used to carry materials from bins to furnace when a heat is made up. As shown here, finished ingots are carried in hoppers to storage areas or directly to shipping dock.

Welded Tube Condenser. Section of condenser test tube sheet with welded tubes developed by Allis-Chalmers Manufacturing Company. The first condenser, a 90,000-sq ft single pass unit, employing welded tubes is being supplied by Allis-Chalmers to a mid-western utility early this year. In connection with this work, the company has developed an automatic welding device with all welding being done with the heli-arc process. To prevent tube-sheet distortion, circular pits or grooves are cut in the tube sheet around each tube hole leaving a collar around the hole which is about as thick as the tube itself. This technique reduces the current required for welding and the corresponding amount of heat generated.

for automatic positioning, gives a steplessly variable range of feeds from $^1/_2$ in. to 10 in. per min, and also a rapid traverse at 120 in. per min. Similar motions are available for the vertical movement of the spindle slide, as well as automatic positioning. Clamping is effected by wedges lined and bushed with plates of P.T.F.E. material, two clamps being provided on the spindle slide and one each on the transverse movement of the table and the vertical adjustment of the boring-stay bearing.

Cavitation in Water Turbines

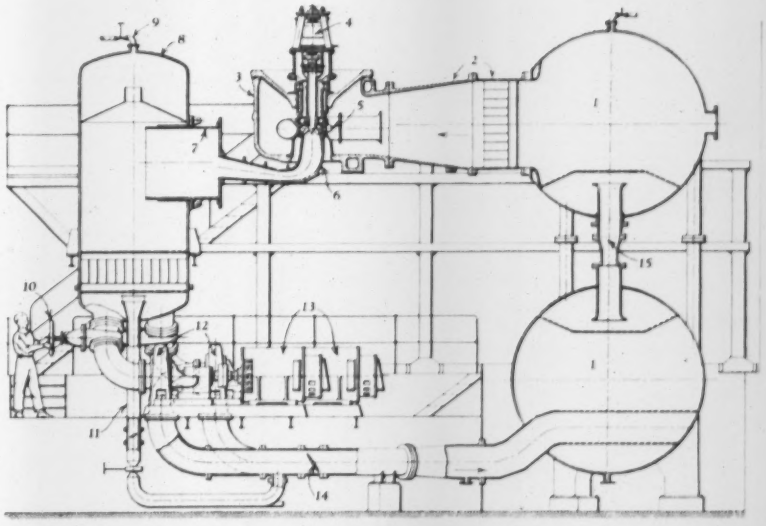
The increasing size of modern water turbines and the high heads which many of these machines are now designed to use have given a new importance to the study of cavitation phenomena to insure that, in the constant search for higher unit outputs, there shall be no avoidable risk of cavitation erosion. Precautionary testing of high-duty designs of both turbines and centrifugal pumps has been carried out for many years by the Swiss firm of Escher Wyss, of Zürich, who installed a closed-cycle testing plant suitable for inputs up to 360 hp more than a quarter of a century ago. They have now supplemented this by a new testing installation which can accept a power input up to 800 hp. The aim was to provide a plant capable of testing complete model turbines and also pumps at the actual heads of the full-sized machines.

With the plant as constructed, this can be done for all Kaplan and propeller turbines, and for a large number of Francis types, as it can be operated at heads up to 100-meter water column. It is not possible to test Francis turbines up to the maximum heads achieved with this type, as these now range up to 450 meters; even then, exact data can be obtained, by running them at reduced heads.

The two centrifugal circulating pumps, each of which takes 400 hp, discharge into a spherical pressure vessel from which the water flows upward through a venturi meter into an upper pressure vessel of the same size and shape, from which it flows to the turbine inlet. The pumps can be operated in series, in parallel, or singly; and the venturi meter can be turned through 180 deg so that trials can be made with either direction of flow. The tail water from the turbine passes through a draft tube fitted with observation windows and thence into a large cylindrical pressure vessel, from which it is recirculated by the pumps. By means of compressed air and a vacuum pump a wide variation of suction and inlet pressure conditions can be imposed quite rapidly, and the changes in cavitation produced can be watched continuously from the control desk with the aid of intense stroboscopic illumination and two observation systems.

The vertical cylindrical tail-water vessel is not completely filled with water. The upper part consists of an air chamber in which the pressure can be varied, as indicated before, to vary the operating conditions. There is also a float regulator which, through a discharge nozzle, controls the total water content of the testing plant, since a permanent supply of cooling water is provided in order to maintain constant temperature of the operating water. If no cooling water were admitted, the temperature of the water in the circuit would increase, under the least favorable conditions, by as much as 8 or 9 C per hr. The chamber in which the model is inserted for testing is designed to withstand the full operating pressure without appreciable deformation. This method of mounting the model has the advantage that the turbine spiral is practically relieved of pressure, so that different designs can be compared by making model spirals of thin sheet. The connection between the draft tube and the tail-water vessel is so arranged that different forms of draft tube can be inserted with the minimum of disturbance to the rig.

The whole of the controls and measurements can be operated or read by one man at the control desk. The hydraulic pressures to be measured act through intermediate oil containers on pistons which are machined to a clearance of only 0.001 mm within their cylinders, the movement of the piston being transmitted to the desk by knife-edge bearings and levers. Calibration is by a mercury gage. Torque measurement is also effected by oil pressure. Speeds are measured electronically. The two pumps are driven by asynchronous motors and each has a maximum delivery head of 50 meters at 985 rpm and a discharge of 300 liters per sec. For double this flow the head is slightly below 40 meters.

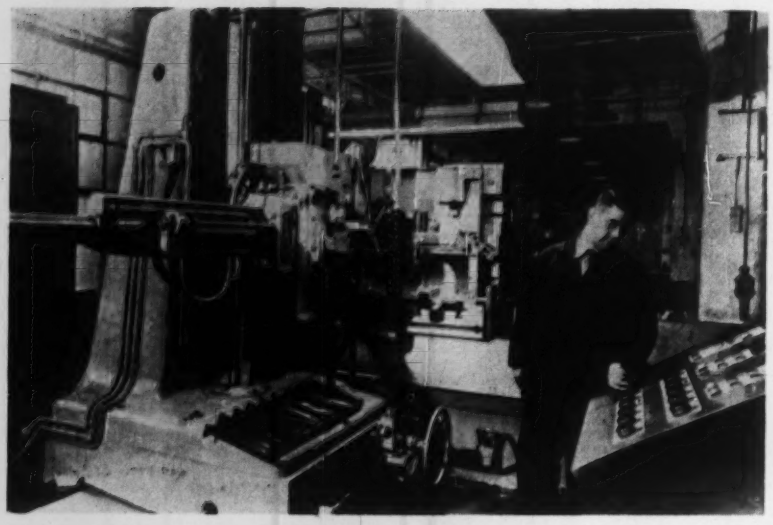


The closed-circuit plant recently installed by Escher Wyss gives heads up to about 100 meters for testing models of water turbines. It can also be used for testing centrifugal pumps. 1, Spherical pressure vessels; 2, inlet with honeycomb equalizer; 3, turbine mounting chamber; 4, hydraulic brake; 5, model turbine in position; 6, draft tube with observation windows; 7, adapter for different draft tubes; 8, tail-water vessel; 9, connections to compressed-air network; 10, change-over valve for pump operation; 11, by-pass pipe; 12, centrifugal pumps; 13, driving motors; 14, butterfly valve for head regulation; 15, reversible venturi meter.

European Survey

Engineering Progress in the British Isles and Western Europe

J. Foster Petree,[1] Mem. ASME, *European Correspondent*



Boring machine, *left*, with automatic co-ordinate-setting control desk, *right*

Boring Machine

For 40 years or more, H. W. Kearns & Company, of Broadheath, Manchester, England, have specialized in the production of precision boring machines. Some time ago they standardized built-in optical measuring systems, with projection screens on the vertical adjustment of the spindle slide and the boring stay, and on the transverse movement of the table, whereby settings could be made to 0.001 in. with an error of not more than 0.00025 in. They have now gone further by adopting the British Thomson-Houston system of automatic co-ordinate setting, by means of which equal (in some cases, even greater) accuracy can be achieved, while the use of jigs is entirely eliminated.

This co-ordinate setter comprises servomechanisms operating the horizontal and vertical slides of the machine, which have traverses of 57 in. and 42 in., respectively. The slides can be set to any position by setting up the co-ordinates on dials on the control desk, six dials being provided for each co-ordinate to indicate the required displacement from a predetermined datum. This is the method used for short runs or "one off" production; for longer runs, the setting can be made by inserting a punched card in a card reader on the control desk and the operation can then be repeated automatically as often as is desired. When the intended co-ordinate position is reached, the slides are clamped automatically.

The electrical measuring system comprises a rigid measuring bar, accurately divided into 1-in. units by holes spaced along its length at centers 1.000 in. ± 0.0002 in. apart. The bar is set up initially in a temperature-controlled room maintained at 68 F. The inch units are steel blocks having, in the face, a $^3/_4$-in. hole filled with a brass insert to present a smooth face. An electromagnetic sensing head is mounted on the bed of the machine and works in conjunction with the bar to give an electrical misalignment signal to the control system. The electromagnetic unit itself can be shifted through a micrometer screw and an accurate instrument servo through any displacement up to one inch. In setting a co-ordinate shift consisting of a number of integral inches and a decimal fraction of an inch, the measuring bar measures the whole inches and the decimal is set by an accurately controlled shift of the sensing head. As the machine approaches the end of the desired travel, the control of the driving motor is taken over by the electromagnetic head and the table movement continues, at progressively reduced speed, until the poles of the magnetic head are aligned opposite to the nearest hole in the bar, when the error signal from the head becomes zero. The error signal is proportional to the displacement of the magnetic head from the desired position and the final approach to alignment is determined by the electronic circuits; it is not affected by such variables as table loading or the viscosity of lubricants. The head is essentially a differential arrangement of two transformers, the magnetic circuits of which are completed by that part of the measuring bar which faces the head.

The boring machine to which this control system is being applied has a main bed 10 ft long which carries a table 3 ft × 6 ft. The main table has a total transverse movement of 4 ft 9 in. and on it is mounted a revolving table 3 ft square, of cellular construction, which can be lifted slightly to reduce the effort required to rotate it.

On both sides and atr ight angles to the main bed are auxiliary beds 4 ft wide, carrying the bases for the upright and boring stay. These bases can be traversed 2 ft along their beds, to give a total distance of 7 ft 6 in. between the spindle nose and the boring stay. Sixteen reversible power feeds are available. The gearbox for the main table drive, in addition to providing the drive

[1] Correspondence with Mr. Petree should be addressed to 36 Mayfield Road, Sutton, Surrey, England.

Practical Economics for Refinery Mechanical Engineers, by T. S. Fennema, Mem. ASME, Humble Oil & Refining Company, Baytown, Texas. 1956 ASME Petroleum Mechanical Engineering Conference paper No. **56—PET-7** (multilithographed; available to July 1, 1957).

THIS paper is based on the premise that, once a problem is clearly defined, the alternative methods of solution should be enumerated and investigated, then the most practical and economic alternative should be selected as the solution. Most problems in any field of endeavor can be solved practically and economically by applying some very basic principles, such as:

1 What is the problem? Define its scope, objectives, and limitations, if any.

2 How many ways can this problem be solved? What are the alternates, economic considerations, and so on?

3 What is the most practical and economical solution? If a higher cost alternate is selected, it should be justified on payout, policy, and so on.

In solving a problem, any alternative which is used above the base case should be justified on an established payout basis.

Several typical examples are presented as evidence that it is necessary to think, inquire, investigate, evaluate and act.

Cold-Weather Pipe Lining, by J. E. Lyle, The Imperial Pipe Line Company, Ltd., Edmonton, Alberta, Canada. 1956 ASME Petroleum Mechanical Engineering Conference paper No. **56—PET-17** (multilithographed; available to July 1, 1957).

THE construction and operation of pipelines during the severe winter weather of Western Canada present unique problems. Ordinarily, pipelines are constructed in Western Canada during the summer months when weather conditions are favorable. However, when it is found necessary to build them during the winter, special methods must be adopted to protect men and equipment to accomplish even the ordinary functions of pipeline construction and operation. This paper on cold weather pipelining has been prepared to present some of the difficulties encountered and to illustrate methods of overcoming them. Though the problems of cold-weather pipelining are not insurmountable, they are certainly costly and sometimes disheartening. To construct pipelines in cold weather, a contractor must be resolute and resourceful in order to overcome such difficulties as repeated snow removals, trenching in frozen group, and adjustments of working conditions to suit varying conditions; while an owner must have a strong justification for the project, great patience with delays and setbacks, and he must be prepared to pay the high costs of winter construction.

Maintenance Organization Factors in The Modern Refinery, by Claud H. Trotter, Refining Department, Phillips Petroleum Company, Bartlesville, Oklahoma. 1956 ASME Petroleum Mechanical Engineering Conference paper No. **56—PET-5** (multilithographed; available to July 1, 1957).

THE primary function of the refinery organization is to provide co-ordinated effort toward better and more economical maintenance. This problem can be solved through the use of several basic factors. Not all the factors are necessary to a good maintenance organization, but the more of them that are properly and diligently employed, the better the possibilities of obtaining maximum efficiency within the organization. These factors are as follows: (1) Control group, (2) work-order system, (3) job planning, (4) preventive maintenance, (5) planned shutdowns, (6) warehouse or stores control, (7) major equipment overhaul, (8) delay studies, (9) equipment improvement, (10) shops and tooling, (11) control by budget, (12) supervisory development, (13) training for hourly maintenance personnel, (14) analysis of performance and costs.

Good human relations are an important part of each factor. The end results of the maintenance effort which is applied to physical equipment are attained through people. These factors constitute a complete maintenance system which will provide a good foundation for successful maintenance. Each one may be improved with time and experience to meet growing and changing conditions. As refineries become more complex, additional emphasis must be placed on maximum efficiency to remain competitive.

Problems Encountered in the Selection and Use of Air-Cooled, Heat-Transfer Equipment, by T. H. King and D. D. Brown, Jr., Magnolia Petroleum Company, Dallas, Texas. 1956 ASME Petroleum Mechanical Engineering paper No. **56—PET-12** (multilithographed; available to July 1, 1957).

THE purchaser of air-cooled heat-transfer equipment would be in a better position to make intelligent selections if manufacturers would give complete information on rating sheets. A standardized form for design and construction data is recommended. More complete information is required on the temperature and pressure limitations of finned tubes. Standardized test methods to serve as a basis for acceptance of equipment are recommended. Operational difficulties are usually minor if the unit has been designed for the proper ambient-air temperature and if the fans deliver the design quantity of air.

In discussing problems associated with this type of equipment, it will be pointed out that lack of information about the design and construction of the equipment makes selection difficult. This lack of complete information can lead to improper selection and, if that occurs, it is fairly certain that operating difficulties will develop. The selection problem is to be discussed; also problems in testing and operation are reviewed. Questions are brought up which are left unanswered in the hope that manufacturers of air-cooled equipment will recognize the difficulties and, in cooperation with the equipment users, strive toward their elimination.

Selection of Materials for Construction of Catalytic Reforming Units, by J. J. Hur, J. K. Deichler, and G. R. Worrell, The Atlantic Refining Company, Philadelphia, Pennsylvania. 1956 ASME Petroleum Mechanical Engineering Conference paper No. **56—PET-8** (multilithographed; available to July 1, 1957).

CATALYTIC reforming, at its inception nearly five years ago, became one of the more important processes for the production of high-octane motor fuels. Currently, most petroleum refiners have at least one reforming unit, and it is estimated that by the beginning of 1957 the total capacity in the United States will far exceed a million barrels per day.

The purpose of the process is to improve gasoline octanes. It is accomplished by catalytically promoting the chemical rearrangement of the hydrocarbons composing the gasoline in the presence of hydrogen and under conditions of elevated temperature and pressure. Coincident with the rearrangement of reforming reactions sulphur is removed from the gasoline to form hydrogen sulphide.

The problems of materials selection center around the high-temperature or reaction section of a reformer.

Two requirements are imposed on the selection of materials for construction of equipment to operate at elevated temperatures (500 to 1000 F) and pressures (30 atm and above) in catalytic-reforming units. These are the proper-

ASME Technical Digest

Substance in Brief of Papers Presented at ASME Meetings

Petroleum Mechanical Engineering

Operating Considerations in the Application of Gas-Turbine-Driven Centrifugal Pipeline Compressors, by A. L. Vaughan, Northern Natural Gas Company, Omaha, Nebraska. 1956 ASME Petroleum Mechanical Engineering Conference paper No. **56—PET-13** (multilithographed; to be published in Trans. ASME; available to July 1, 1957).

THE author's company, Northern Natural Gas Company, has operated two gas-turbine stations through three winter heating seasons. Each of these stations consists of four 5700-hp gas-fired turbine-driven, centrifugal compressors arranged in series. The fundamental reasons behind the decision to use turbines in this application are presented here, as are the anticipated related operating and maintenance costs.

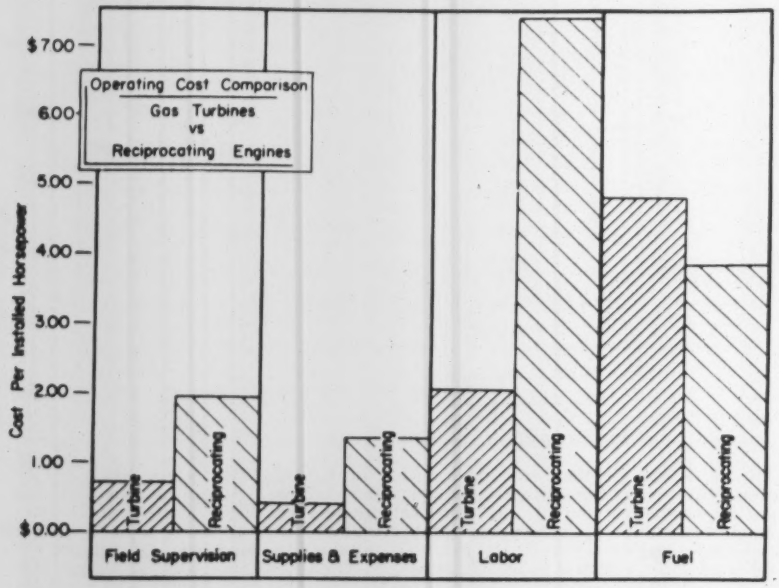
Since the initiation of large-diameter interstate pipeline systems, the growth of the natural-gas industry has been phenomenal. This rapid expansion along with increasing costs of compressor-station facilities has left the industry in a position where it must be ever cognizant of new developments in equipment and techniques. In many cases the industry has been obliged to accept a new development on a large scale long before it had been thoroughly proved and accepted. This was Northern's position when the decision was made to install gas-fired, turbine-driven centrifugal compressors in the 1953 expansion program.

The author gives a resume of operating experience with gas-fired turbine prime movers driving centrifugal gas compressors.

Centrifugals were preferred to reciprocating compressors for operations at very low ratios.

A fundamental characteristic of gas-fired turbines is their ability to develop more horsepower at low ambient temperatures.

Operating labor is a fixed cost whether the plant is or is not in operation. Completion of estimates placed the gas turbines in approximately the same relative cost position as the reciprocating plants, which position was later verified by actual cost figures.



Major savings from the installation of turbines by The Northern Natural Gas Company have been in operating labor

The company is confident that the over-all reliability of a turbine station will be comparable with its reciprocating stations. There has been no shutdown in three years with the turbines.

Operating costs are a prime consideration in the selection of any type of compressor-station installation. The figure is a summary of operating costs for turbine and reciprocating stations. The stations considered are not a composite of all reciprocating stations on the company's transmission system but are specific ones which operate on a comparable load factor.

The figure illustrates that major savings from the installation of turbines have been operating labor.

A factor favoring turbines is the low oil consumption for that machine as compared with reciprocating engines.

The fuel costs which are compared in the figure are total station costs including auxiliaries. The cost figures shown are on the basis of rated horsepower, and do not take into account the extra horsepower developed by the turbine at lower ambient temperatures.

Turbine-plant maintenance requirements and costs are still a relatively unknown factor so far as Northern is concerned. Currently one turbine has been inspected and overhauled at each of the two turbine stations. If the two turbines which we have inspected are indicative of what we may expect in the future, the maintenance picture is an encouraging one.

In conclusion, the gas-fired turbines have operated through three heating seasons, in which time the turbines have proved themselves to be equally reliable with reciprocating-compressor stations. The operating and maintenance expenses for the turbine stations were approximately $5.00 per brake horsepower, less fuel, per year as compared to approximately $13.50 for other reciprocating stations which operate on a comparable load factor. The major part of this saving is in operating labor.

It is apparent that there is much to be gained by installing facilities with large-horsepower units and to provide sufficient controls and safety devices so that operating labor costs may be held as low as possible.

industrial-manufacturing plant installation in the nation of a gas-turbine generator with a heat recovery boiler to produce steam for process, or to supply existing steam turbine generators. Capacity of the boiler unit is increased by supplementary firing, either natural gas or heavy fuel oil, with all combustion air supplied by the turbine exhaust. A forced-draft fan makes possible full boiler capacity during outage of the gas turbine.

Instruments and Regulators

The Effect of a Logarithmic Element in an Otherwise Linear Process-Control System, by Dr. G. L. d'Ombrain and A. Rashwan, Battersea Polytechnic, London, England. 1956 ASME Joint IRD-ISA Conference paper No. **56—IRD-19** (multilithographed; available to July 1, 1957).

THE paper describes the application and the extension of a mathematical method of dealing with a nonlinearity system originally described by A. Tustin (*Journal of the Institution of Electrical Engineers*, vol. 94, 1947). The nonlinearity used to illustrate the method is the effect on an otherwise linear system of including a modulating element having a logarithmic form, such as an equal percentage valve.

The system investigated is a three-stage process controlled by combinations of proportional, integral, and derivative control modes. The system disturbances considered are those due to changes in desired value and in load. The validity of the computations is checked by comparison with an electrical simulator. The method is not restricted to mathematical nonlinearities and, to further illustrate the versatility of the method, the effect of dead time and saturation of the valve is considered.

The Application of an Analog Computer to the Measurement of Process Dynamics, by P. E. A. Cowley, Shell Development Company, Emeryville, Calif. 1956 ASME Joint IRD-ISA Conference paper No. **56—IRD-20** (multilithographed; available to July 1, 1957).

THE usual method of obtaining frequency-response measurements is described. The data obtained are reduced by visual inspection, but difficulties arise due to distortion and noise in the process. The range of frequencies over which measurements can be made is limited by noise and distortion and may prove inadequate for studying the stability of the process when controlled. These shortcomings may be overcome by methods of frequency-response measurement in which the data are reduced by means of a computer rather than by visual inspection. Two methods of frequency-response measurement using an analog computer for data reduction are described. Results are given of laboratory measurements on a dummy process and of field measurements on a real process. The advantages of computer reduction of the data are clearly demonstrated. The further advantages to be derived from digital computation rather than analog computation are indicated.

The Application Limits and Accuracies of Control-Valve Flow Coefficient CV, by D. J. L. Lin, and A. J. Hanssen, Mem. ASME, Black, Sivalls & Bryson, Inc., Tulsa, Okla. 1956 ASME Joint IRD-ISA Conference paper No. **56—IRD-22** (multilithographed; available to July 1, 1957).

A CONTROL valve is a variable orifice. Its function is to create variable resistances in a flow system and thereby establish and maintain the desired control setting (whether pressure, temperature, flow rate, or liquid level) of the system.

In any automatic control system, proper selection of the control valve is reflected in the performance and the initial, operating, and maintenance costs of the system. Regardless of the sensitivities and accuracies of the sensing and actuating instruments, the system performance depends upon the accurate sizing of the control valve to create the necessary flow resistance as dictated by the instruments. From the installation and maintenance standpoints, the "oversized" control valve necessitates the positioning of the inner valve near the valve seat where greater wear due to possible wiredrawing and erosion will result in higher initial costs and maintenance expenditures. On the other hand, when an "undersized" control valve must be modified or replaced to attain the designed maximum system capability, significant costs may be expected in system revamping and down time.

The accuracy of control-valve sizing depends upon the individual and collective accuracies of the following factors:

1 The control-valve-inlet and outlet-flowing conditions.

2 The control-valve flow-resistance rating (flow-coefficient rating).

3 The applicability of control-valve flow coefficient with respect to various process variables and type of fluid flow.

The paper is devoted in its entirety to the accuracies of control-valve flow-coefficient determination and the applicability of said coefficient to compressible and incompressible fluid flows within the turbulent and subsonic-flow regions. For simplicity of presentation, the type of control valve considered herein is limited to the conventional, direct-operating, globe-type bodies. In the case of double-port bodies the flow shall enter between the seats, and in the case of single-port design the flow shall tend to open the inner valve. Control-valve resistances discussed are limited to rated travel or inner valve at wide-open position only.

Criteria for Validity of Lumped-Parameter Representation of Ducting Air-Flow Characteristics, by G. J. Fiedler, Sverdrup & Parcel, Inc., St. Louis, Mo., and T. R. Stalzer, McDonnell Aircraft Company, St. Louis, Mo. 1956 ASME Joint IRD-ISA Conference paper No. **56—IRD-21** (multilithographed; available to July 1, 1957).

THE flow of compressible fluid in a long pipe or duct is somewhat analogous to the flow of electric current in a long transmission line. For accurate representation of gaseous flow at high frequencies in a long duct the resistance, inertance, and capacitance parameters must be considered as distributed along the duct. Air pressures and weight flow are functions of time and distance along the duct.

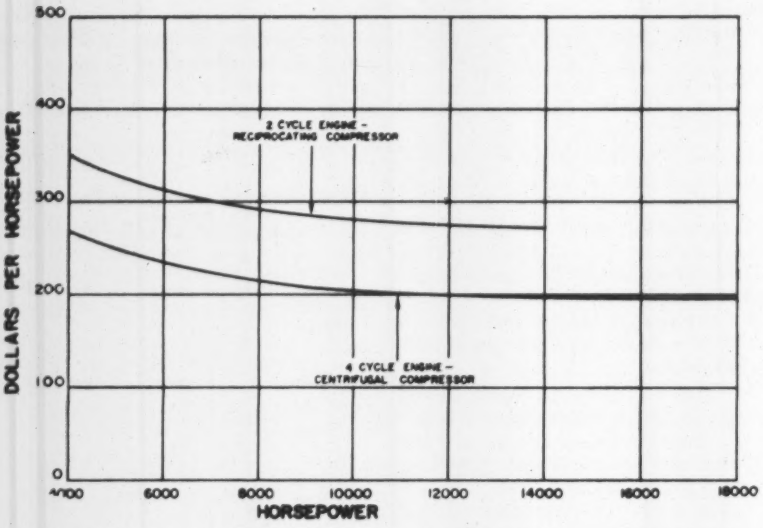
For control-design purposes the lumped-parameter representation of ducting elements is more convenient and simpler to use. The purpose of this discussion is to develop a simple, general numerical criterion to determine rapidly the conditions under which lumped representation of a distributed ducting element is valid. To develop this criterion, equations and transfer functions for both distributed-parameter and lumped-parameter representation are derived and compared for a practical ducting-and-valve system.

An Analytical Study of Linearized Industrial Process Controllers, by D. D. Nye, Jr., Assoc. Mem. ASME, Fielden Instrument Division, Robertshaw-Fulton Controls, Philadelphia, Pa., and R. Y. Paradise, Kearfott Company, Inc., Clifton, N. J. 1956 ASME Joint IRD-ISA Conference paper No. **56—IRD-23** (multilithographed; available until July 1, 1957).

IT HAS been common practice to consider certain automatic controllers as devices capable of producing idealized control actions. These actions are pure proportional position, pure rate, and pure reset. Control terms which have been accepted as standards are defined on the basis of these idealized actions. However, practical controllers vary widely from these idealizations, even when only their linear characteristics are considered.

It is apparent, therefore, that, if a more

ties (1) to withstand hydrogen attack and (2) resist hydrogen-sulphide corrosion. Hydrogen attack can be precluded by the use of carbon-molybdenum and/or low-chromium alloy steels and by special equipment designs. Generally, these measures are not adequate to mitigate hydrogen-sulphide corrosion. It will be shown that, in a hydrogen atmosphere, hydrogen sulphide is an active corrodent under the conditions of concern at concentrations well below 0.05 volume per cent and that, depending on the concentration, alloy steels containing in excess of 9 to 12 per cent chromium are required to provide significantly greater corrosion resistance than is provided by plain carbon steels. A portion of the discussion is devoted to a review of the process and equipment-design features of catalytic reforming and their relationship to materials selection as affected by hydrogen-sulphide content of the process flows.



Construction cost comparison of remote-controlled gas-compressor stations

Remote-Controlled, Engine-Driven, Centrifugal, Gas-Compressor Station, by R. Lochiano, Gulf Interstate Gas Company, Houston, Texas. 1956 ASME Petroleum Mechanical Engineering Conference paper No. **56—PET-22** (multilithographed; available to July 1, 1957).

GULF Interstate Gas Company completed construction on the first of this year of an automatic remote-controlled compressor station located on its main line near Stanton, Kentucky. This station has a four-cycle, turbocharged engine driving a centrifugal compressor through a gear increaser. The station is controlled automatically by a controller which maintains a constant discharge pressure by varying the speed of the engine.

The station is completely unmanned except for a maintenance mechanic who is on duty 40 hr a week. The operation is performed remotely from the next compressor station located some 90 miles away, which we term the master station. The operator at the master station has the ability to change the set point on the discharge pressure controller, and to start or stop the engine.

At the time the decision was made to install an engine-driven centrifugal compressor, there were no other similar units in service on gas pipelines. The natural question one would ask then is: Why would a company select equipment that had not been tried out before? Of course, actually there is nothing new about any of the components. The four-cycle engine and the centrifugal compressor are both in common usage; it is only their combination then, as specifically applied to the gas industry, that is untried. The reason the particular engine-centrifugal compressor combination was selected was that it affords the most economical station for Gulf Interstate Gas Company's type of operation.

Offshore Mobile Units—Present and Future, by R. J. Howe and B. G. Collipp, Shell Oil Company, Houston, Texas. 1956 ASME Petroleum Mechanical Engineering paper No. **56—PET-24** (multilithographed; to be published in MECHANICAL ENGINEERING; available to July 1, 1957).

DURING the past few years there has been a rapid increase in world-wide offshore drilling activity. Although the great majority of these wells have been drilled from fixed platforms, the number of mobile units has been increasing steadily since 1949 until, at the end of 1955, there were about thirteen in use. The number in operation should double during 1956. This is a spectacular development when one considers that each unit costs anywhere from two to seven million dollars. Although there has been a wide variation in the design of these twenty-five or so mobile units, they have experienced a fairly orderly evolution from shallow to deep water. Some of the reasons for this development will be described in the present paper.

As with any new type of equipment, offshore mobile units have had their share of problems. Examples of the problems encountered by some of the units have been piling difficulties, pontoon control problems, jack failures, fire, movement during moderately severe storms, and many other minor difficulties. Nevertheless, these setbacks have been met and all of the mobile units which have experienced difficulties are actually operating today.

The major problem facing offshore designers is the nature and extent of the forces imposed on a fixed object standing in a body of water by a hurricane.

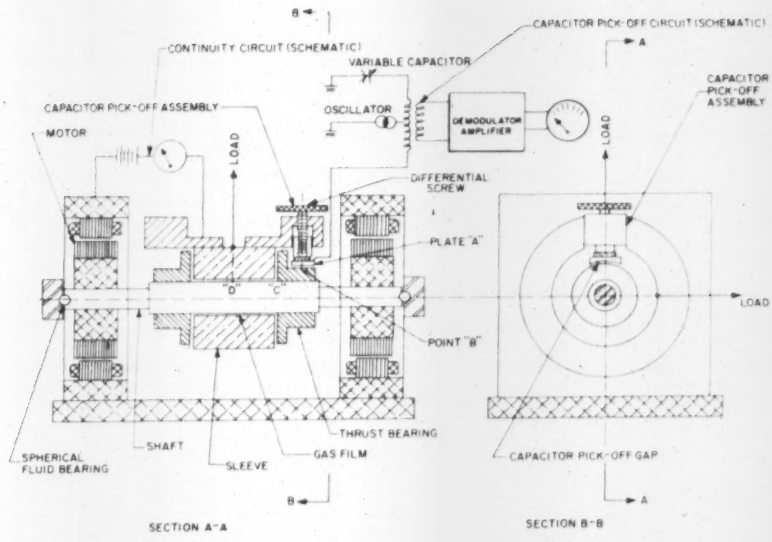
At the present time a wide variation in design exists between all types of platforms which are being used in the same locality and depth of water.

This paper deals with the development of offshore mobile units during their first five years of operation. Detailed information is presented for the forty or so units which are currently in operation or under construction, and each is classified by means of a uniform system. Mobile platform developments in fields other than offshore drilling are discussed, and some engineering speculation is advanced relative to the probable trend of mobile designs during the next five years.

Gas Turbine Power

An Industrial Plant Installation of a Gas Turbine to Generate Power and Process Steam, by H. L. Dwyer, Assoc. Mem. ASME, Stearns-Roger Manufacturing Company, Denver, Colorado; and C. A. Payne, Gates Rubber Company, Denver, Colorado. 1956 ASME Fall Meeting paper No. **56—F-21** (multilithographed; available to July 1, 1957).

DESIGN features and economics are presented in this paper for the first



Sketch of test setup for investigation of gas-lubricated journal bearings. Main components include a shaft and a sleeve separated from the shaft by the gas film under investigation.

Experiments on Gas-Lubricated Journal Bearings, by M. Wildmann, North American Aviation, Bellflower, Calif. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-8** (multilithographed; available to August 1, 1957).

ALTHOUGH the possibility of lubrication with a gas has been recognized for over 100 years, the amount of theoretical and experimental data available on that subject is surprisingly small. This might be due to the fact that little use was found for a bearing with low load capacity. But in applications such as instrument bearings, load capacity is often a secondary consideration, while qualities such as absence of vibration, absence of wear particles, absence of oil drip, small power consumption, and high stiffness are important. In such cases, lubrication with a gas presents definite advantages.

It is believed that the experiments described here are the first investigation of a gas-lubricated journal bearing in which all the main variables, that is gap, radius, length, speed, ambient pressure, ambient gas, and load were varied, and the effect of each upon deflection and attitude angle noted.

Note should be taken of the fact that this paper concerns itself only with gas bearings where the load capacity comes from the hydrodynamic phenomenon, and not hydrostatic gas bearings, where at least part of the load capacity comes from gas supplied to the bearing, under pressure, from an external source.

A sketch of the test setup is given in the figure. Its main components are a shaft and a sleeve separated from the shaft by the gas film under investigation.

Universal Bearing Tester, by R. J. S. Pigott, Fellow ASME, 755 Old Mill Road, Pittsburgh, Pa., and B. R. Walsh, Mem. ASME, Gulf Research & Development Company, Pittsburgh, Pa. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-9** (multilithographed; available to August 1, 1957).

MANY bearing testers of one type or another have been devised by those who have investigated bearings. Nearly all of these, from Thurston's old pendulum type through Kingsbury's, have been for unidirectional load only, therefore limited to just one of the three classes of load we need to know about. Most of the early machines lacked the precision now required for a study of bearing conditions. It will be perceived that since the coefficient of friction may be less than 0.001, a bearing tester for, say, 25,000-lb bearing load, must have response to less than 0.25-lb. friction force if accuracy is to be better than ±1 per cent. The authors' initial work on bearing test machines was directed toward improving precision and sensitivity, but unidirectional loading was retained. Later it was recognized that the unidirectional-load test machine did not provide data representing dynamic loads of varying direction and magnitude. This led to the development of a rotating-load bearing test machine. The steps in this development are outlined in the paper.

Heat-Transfer Effects in Hydrostatic Thrust Bearing Lubrication, by W. F. Hughes, Assoc. Mem. ASME, and J. F. Osterle, Assoc. Mem. ASME, Carnegie Institute of Technology, Pittsburgh, Pa. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-11** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

THE limiting isothermal and adiabatic operating conditions of the hydrostatic thrust bearings have recently been investigated. However, the actual performance of such bearings is characterized by an intermediate situation in which heat transfer occurs in the lubricant and bearings. In this paper a significant model is constructed for such intermediate situations, and it is found that the bearing performance is essentially isothermal at an elevated temperature. Expressions are derived for the temperature distribution, and the results of numerical examples are compared with isothermal and adiabatic calculations.

Testing Dynamically Loaded Bearings—II, A Diesel-Engine Bearing Test Machine, by R. B. Snapp, Assoc. Mem. ASME, and M. D. Hersey, Fellow ASME, U. S. Naval Engineering Experiment Station, Annapolis, Md. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-4** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

A PROGRAM of diesel-engine bearing investigation, authorized by the Bureau of Ships, was initiated at the U. S. Naval Engineering Experiment Station in 1947. One phase of this program required the study of present-day bearing materials under standardized conditions in a test machine that would simulate engine loading. Many such machines capable of producing dynamic loads have been described in literature, but only a few offered the combined centrifugal, reciprocating inertia and gas loading that are encountered in engine operation today. None appeared to be suitable for the type of endurance testing that was planned.

A test machine, consisting of a motor-driven modification of a commercially available diesel engine, was therefore developed. This machine combined the advantages of engine operation with those of a standardized test machine. By motor-driving the engine it was also possible to remove all fuel and exhaust

accurate description of a controller is desired, it is necessary to consider additional characteristics of the controller. By choosing characteristics which in some manner describe how closely a practical controller approaches the idealized type, the terms defined for idealized types can be extended and retained along with the new terms.

The purpose of this paper is to choose terms which describe completely and conveniently the linear operation of an automatic controller, and to utilize these terms in the analysis and comparison of all basic controller types.

Electronic, hydraulic, pneumatic, and thermal types have been considered. By use of block diagrams they are put into a common form. Operational principles thereby become more evident and the controllers are more easily compared.

Lubrication

Properties of Misaligned Journal Bearings, by G. B. Du Bois, F. W. Ocvirk, and R. L. Wehe, Assoc. Mem. ASME, Cornell University, Ithaca, N. Y. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-7** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

In a misaligned journal bearing, the journal axis and the bearing axis, in general, are nonparallel and nonintersecting in three dimensions, as shown in the figure. Considering the true size of the oil-film thickness in relation to the bearing length it is apparent that the film thickness at the ends of journal bearings is considerably reduced by tiny amounts of angular misalignment. Misalignment may result from elastic deflection under load, thermal distortion of the shaft and the bearing supports, unavoidable error in manufacture, or from the application of misaligning couples. In general, misalignment occurs in combination with a radial central load, as shown in the figure.

Curves in dimensionless form give journal-bearing attitude as a function of the usual bearing variables and the couples which produce misalignment. Examples are given showing the application of the dimensionless curves to typical problems of misaligned bearings.

Statistical Analysis of a Wear Process, by B. G. Rightmire, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-10** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

Five types of wear are recognized: Cutting, abrasive, chemical, fatigue, and residual. Holm advanced a theory of a residual wear process in which wear particles of atomic size were supposed to be formed directly from encounters between pairs of high spots on the sliding interface. Burwell and Strang found that their results for steel riders rubbing on a lubricated, hard-steel disk depended linearly on load and sliding distance, as predicted by Holm's theory. Their wear particles, however, were much larger than atomic size. Archard showed that Holm's wear equation could be deduced without postulating the size of the wear particles.

Kerridge has recently measured by radioactive-tracer methods the wear of a soft-steel rider (270 Vickers) rubbing on a hard-steel ring (860 Vickers). Kerridge found in his experiments that metal was first transferred from rider to ring and formed there a thin, gray layer harder than the rider. There was no transfer to this layer, neither were any wear particles formed directly from the rider. No back-transfer to the rider occurred. Patches of a brown powder were observed on the gray, transferred layer, and all the wear particles were found to consist of a similar powder, which was shown by x-ray diffraction to be α—Fe_2O_3. Kerridge concluded that this was a three-step process, rather than a one-step process such as considered by previous workers. The three steps were: (1) The transfer of rider material to the ring; (2) the oxidation of this transferred material; (3) the rubbing off of the oxide to form a loose wear product.

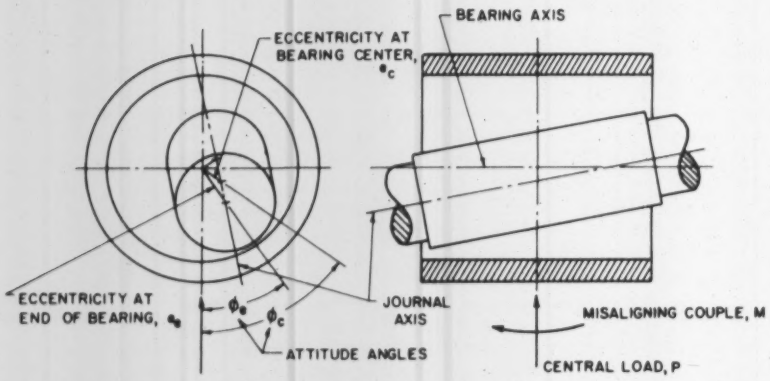
It is recognized that the experiments of Kerridge treat only one case of the general problem of residual wear. The good reproducibility and completeness of these results provide, however, a firmer base for analysis than has hitherto been available.

The object of the present paper is to formulate from the statistical behavior of the many, small interfacial contacts an expression for the metal transfer to the ring, a variable determined experimentally by Kerridge. Estimates are thus obtained for the probability of material being rubbed from a transferred spot during one revolution of the ring, and for the number of rubs needed to remove completely a transferred spot. The magnitudes of these are found to be consistent with the wear mechanism suggested by Kerridge.

Surface Roughness—A Criterion for Minimum Hydrodynamic Oil-Film Thickness of Short Journal Bearings, by L. F. Kreisle, Mem. ASME, University of Texas, Austin, Tex. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-5** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

The minimum hydrodynamic oil-film thickness of a short journal bearing is defined as that value of the minimum oil-film thickness at which marginal procedures initially are substituted for hydrodynamic-film lubrication. This appears to occur when the minimum oil-film thickness equals the sum of the predominant-peak surface roughnesses of the bearing and journal, measured in the circumferential direction after run-in of bearing and journal.

The investigations reported in this paper were conducted in order to determine a criterion at which marginal lubrication procedures initially are substituted for hydrodynamic-film lubrication of short journal bearings with length-to-diameter ratios less than 1.



Nonparallel and nonintersecting axes of a misaligned journal bearing in three dimensions

the determination of ignition temperature, which has been defined in so many ways, but which basically involved an attempt to give a numerical characterization to an over-all phenomenon describing a threshold temperature of ignition, a minimum temperature of sustained combustion, or a temperature at which the heat developed by the reactions producing ignition exceeds that which is lost to the surroundings. The potential useful application of data furnished by a suitable test of this kind was recognized.

In practice, solid fuels exhibit varying tendencies and abilities to ignite spontaneously in storage piles, to become ignited and reach active burning conditions when fed to a furnace, to maintain hold-fire conditions, or to perform satisfactorily in pulverized-coal-fired or cyclone-fired furnaces. A criterion was sought that would, when applied in conjunction with other analytical and test data, permit the intelligent selection of fuels for specific applications. The purpose of this paper is to review the fundamental factors that must be considered in regard to ignitibility, and the principles and some of the methods that have been employed for its determination, and to discuss the possibility of useful application of the results.

Progress Report—Ignitibility of Solid Fuels and Burning Rates of Fixed Carbon, by Norman D. Phillips, The Babcock & Wilcox Company, Alliance, Ohio. 1956 ASME-AIME Joint Fuels Conference paper No. **56—FU-5** (multilithographed; available to August 1, 1957).

Results of preliminary combustion trials indicate that standard fuel analyses are not adequate for predicting furnace performance with the solid fuels now being obtained from certain new processes in the coal and petroleum industries. This paper describes laboratory tests and procedures that have been developed in an effort to obtain a more reliable indication of expected performance from these new fuels. These new fuels are chars formed during low-temperature carbonization of coal and petroleum cokes.

The ignition temperature test described is used to obtain data which have been found to correlate reasonably well with actual performance.

A method is shown for correlating fuel properties with unburned carbon loss in furnaces.

A laboratory method for determining a burning-rate index is described. Burning rates are correlated with unburned carbon loss data as an aid to the selection of proper combustion equipment.

Determination of Heat Content of Coal by Regression Analysis, by R. L. Pasek, Northwestern University, Evanston, Ill., and R. M. Lundberg, Mem. ASME, Commonwealth Edison Company, Chicago, Ill. 1956 ASME-AIME Joint Fuels Conference paper No. **56—FU-4** (multilithographed; available to August 1, 1957).

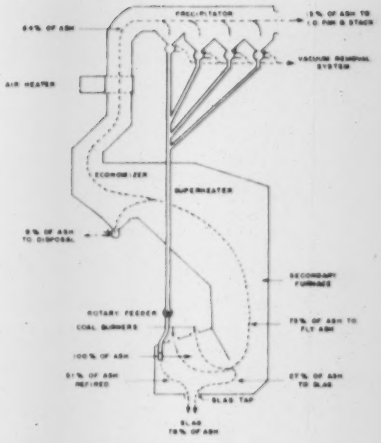
This paper presents an analytical method based upon regression analysis for determining the heat content of coals of essentially the same rank. A line of regression was calculated from dry ash and dry Btu determinations for 42 samples of coal from various sources. With this line of regression it is shown that the heat content of similar coals can be predicted from measurements of ash content with adequate accuracy for station calculations. A method is presented for calculating the effect of error in ash determination upon the error in Btu determination, thus virtually eliminating extensive testing for heat content.

An Effort to Use a Laboratory Test as an Index of Combustion Performance, by F. J. Ceely, Assoc. Mem. ASME, and R. I. Wheater, Mem. ASME, Foster Wheeler Corporation, New York, N. Y. 1956 ASME-AIME Joint Fuels Conference paper No. **56—FU-6** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

Discussed here are results of a study in progress to determine if the Coal Research Laboratory of Carnegie Institute of Technology Reactivity Test can be applied as an index of combustion performance in pulverized-fuel-fired steam generators. Before undertaking an extensive program of correlating laboratory data against actual combustion experience, it was necessary to conduct the study on a limited basis to establish whether or not the results would justify an extensive effort. The authors present some significant data accumulated during this study phase and conclude that further investigation is warranted on a larger scale.

Fly-Ash Refiring, by W. W. Maull, Marion Generating Station, and E. C. McMahon, Sewaren Generating Station, Public Service Electric & Gas Company, Newark, N. J. 1956 ASME-AIME Joint Fuels Conference paper No. **56—FU-1** (multilithographed; available to August 1, 1957).

Over the past twenty-five years the problem of fly-ash disposal has been a pressing one. The ever-increasing attention given to stack emission demands that fly ash be collected and disposed of as efficiently as possible. This paper discusses the refiring method of disposal,



Typical fly-ash refiring system for 1250-lb boiler at Marion Generating Station, Newark, N. J.

which occurs when the fly ash is reinjected into the furnace to be burned again.

All of the heat of the combustible in the fly ash plus the heat of the furnace itself raises the temperature of the fly ash to a point above 2800 F, at which point it becomes molten slag. In this white-hot condition it flows over the floor to the slag tap and spills into the ash tank below. Upon striking the water in the tank, it forms black crystals Hence its trade name of mineral granules or slag.

In most cases the purpose of refiring fly ash is to get rid of it by turning it into a more disposable or salable product. This saves storage space and the cost of removal later.

However, where the combustible in the ash is excessive, then it is more efficient to refire it and recover the heat value in it.

Industrial Fuel Utilization in the United Kingdom, by W. A. Macfarlane, The National Industrial Fuel Efficiency Service, London, England. 1956 ASME-AIME Joint Fuels Conference paper No. **56—FU-3** (multilithographed; available to August 1, 1957).

Faced with the fact that the United Kingdom had ceased to be a country with surplus energy obtainable from indigenous sources, and that demands for fuel were greater because of increased industrial production, the National Industrial Fuel Efficiency Service was established in 1953 to offer independent and impartial advice on utilization of all types of fuels. How successful NIFES has been in this

equipment, thus considerably simplifying both operation and maintenance and permitting greater control of test conditions. Gas and combustion loads were simulated by compressing air in the cylinders which, combined with the normal centrifugal and inertia loads, produced the same type of bearing loading as occurs in engine operation. However, a considerable increase in loads over those normally found in this type engine was obtained by increasing both speed and compression pressures. Two of these machines, shown in the figure, have been built and are now in regular operation.

A rating system is described for evaluating the extent of various kinds of failure elements so that bearings may be compared without testing them to destruction. Test results and the use of an oil-film-thickness indicator also are described briefly.

Testing Dynamically Loaded Bearings—I, A Short History of Bearing Test Machines, by M. D. Hersey, Fellow ASME, and R. B. Snapp, Assoc. Mem. ASME, Internal Combustion Engine Laboratory, U. S. Naval Engineering Experiment Station, Annapolis, Md. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-3** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

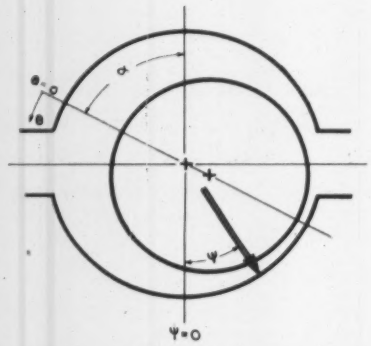
BEARING test machines with dynamic loading or nonuniform motion are described in this paper and classified according to the type of loading employed. Over thirty such machines have been disclosed in the published literature, including both endurance machines and research machines for investigating oil-film performance. No sharp line of demarcation is possible, since machines designed for other purposes could later be used for endurance testing.

The authors have endeavored to find answers to six questions concerning each machine: (1) Its loading mechanism; (2) test-bearing details; (3) range of variables; (4) performance criteria; (5) characteristic limitations or advantages; and (6) extent of use.

The Fluid Dynamic Theory of Gas-Lubricated Bearings, by J. S. Ausman, Garden Grove, Calif. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-6** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

A DIFFERENTIAL equation for the pressure distribution in gas-lubricated slider bearings is derived from the basic equations of fluid mechanics. The equation is an extension of Harrison's gas-bearing equation in that the infinite width and isothermal restrictions have been removed. A perturbation solution is proposed and is carried out for the special case of an infinitely wide, self-lubricating journal bearing. Comparisons with numerical solutions to Harrison's equation indicate that the first three terms in the series solution are sufficient to determine the pressure distribution and bearing load with reasonable accuracy.

Analysis of Journal Bearings With Arbitrary Load Vector, by O. Pinkus, Associate Mem. ASME, Israel Institute of Technology, Haifa, Israel. 1956 ASME-ASLE Lubrication Conference paper No. **56—LUB-2** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).



Sketch of standard journal bearing having two axial grooves at the horizontal split

MOST of the research conducted in the field of statically loaded bearings has concerned itself with loads acting at a fixed position with respect to the bearing boundaries. In practice, however, one very often encounters loads that are positioned at any arbitrary angle with respect to the oil grooves. Typical examples are bearings in ship-propulsion units where the load vector changes direction upon switching from forward to astern running. Also there exists an optimum spacing of the load vector with regard to the bearing's load capacity or oil flow. Thus the need for obtaining solutions for any arbitrary position of the load vector is more than of theoretical interest.

This paper deals with the standard type of journal bearing having two axial grooves at the horizontal split, as shown in the figure, which leaves two active bearing arcs of 150-deg span with the case of a vertical load. This paper provides solutions for any arbitrary position of the load vector over the entire span of the bearing. The relative position of the load vector obviously results in different values of eccentricity ratio, power loss, and oil flow, and these are given as a function of the load angle ψ. The method of obtaining results is based on the actual solution of Reynold's equation for finite bearings, performed on a digital computer, as given in a previous paper by the author ("Analysis of Elliptical Bearings," by O. Pinkus, Trans. ASME, vol. 78, July, 1956).

On the Theory of Grease-Lubricated Thrust Bearings, by A. Slibar, Scientists Research Project, Massachusetts Institute of Technology, Cambridge, Mass., and P. R. Paslay, Assoc. Mem. ASME, General Electric Company, Schenectady, N. Y. 1956 ASME-ASLE Third Lubrication Conference paper No. **56—LUB-1** (multilithographed; to be published in Trans. ASME; available to August 1, 1957).

EXPERIMENTAL results have shown that grease can be considered to be a Bingham material. By introducing the yield criteria due to Hencky-von Mises-Huber, the stress-deformation rate relations for the lubricating material are derived. Making use of the characteristic parameters of a rotating thrust bearing, a perturbation procedure is used to obtain a solution governing the steady state. When the critical shear stress of the grease equals zero, this solution becomes the viscous one. Curves are given for design purposes which can be used by the lubrication engineer directly to obtain the prediction of the properties of a thrust bearing.

The paper gives a solution in three dimensions for the steady state of a rotating thrust bearing. There is introduced a three-dimensional stress-deformation rate relation for the grease, and an approximate solution is obtained which makes use of parameters that are small for most practical cases of thrust bearings lubricated with grease.

Fuels

Ignitibility Testing as a Measure of the Burning Characteristics of Solid Fuels, by H. W. Nelson, Mem. ASME, and J. M. Pilcher, Mem. ASME, Battelle Memorial Institute, Columbus, Ohio. 1956 ASME-AIME Joint Fuels Conference paper No. **56—FU-2** (multilithographed; available to August 1, 1957).

OVER a period of years, considerable effort has been devoted to the development of laboratory test procedures which would characterize what might be termed the ignitibility properties of solid fuels. Earliest attempts were concerned with

The ASME Council Reports

Activities in 1955-1956

The 1955–1956 year was a year of sound accomplishment marked by the brilliant 1955 Annual Meeting which closed the 75th Anniversary celebration, and by increased meeting activities, continuing interest and enthusiasm in the Sections, a conservative growth in membership, a substantial increase in income, and a broadened international program. The backlog of unpublished papers was reduced to a figure approaching normal. The research program operated at a greatly increased rate, though still far below the potential rate. The codes and standards work resulted in a greatly increased output of published material, the largest volume of which was the 1956 edition of the Boiler and Pressure Vessel Code. An activity of twenty-five years' standing, the co-operation between the American Petroleum Institute and the Society in issuing a code for construction of pressure vessels was brought to a close, because the ASME Code provided the necessary guidance. A broadened public-relations program for all Society activities was initiated on a five-year basis.

An important conclusion reached jointly with four other national societies was the decision to erect the proposed engineering center in New York City, perhaps on the site now occupied by the Engineering Societies Building.

An innovation that should have far-reaching effects was a comprehensive change in the policies and procedures affecting Student Members which gives them a much greater recognition in Society activities. A dramatic stimulus to student interest was the bringing together in Cleveland, in June, of the twelve winners in the regional student conferences made possible by the "Old Guard" (members now dues-exempt). The winner at Cleveland will be brought to the 1956 Annual Meeting to receive the special Old Guard prize.

The procedures and policies for administering Society honors and awards were modified with consequent improvement. During the year a new Timoshenko Medal was authorized, a gift of the Applied Mechanics Division. At the close of the year arrangement had been completed with five other societies to sponsor jointly a Charles Franklin Kettering Award to recognize outstanding inventions.

As a fitting activity in its 75th year a review was instituted of the Society's aims and objectives and the methods of implementing them, and a report was made at the 1955 Annual Meeting.

The foregoing items are dealt with in more detail in subsequent paragraphs and in full in the reports of the various Boards and Committees to the Council.

New Engineering Center

Five societies (ASCE, AIME, ASME, AIEE, and AIChE) in 1954 agreed to work out together the solution of the problem of an adequate center for the engineering profession. A report on the problem in 1955 met with the approval of only one society, and at the start of this fiscal year a task committee of fifteen was organized and provided with funds to engage consultants. This committee reported on June 27, 1956, recommending that the center be located in New York on the present site. Before September 30, the boards of the five societies approved this recommendation. The committee made additional recommendations as to means of carrying out the report. As these involved United Engineering Trustees Inc., which is the custodian of the present building, and AIChE is not a member body of the Trustees, the carrying out of the implementation recommendations must be delayed while the entrance of AIChE into the Trustees is negotiated.

Society's International Program

The activities of the Society in co-operation with engineers and societies outside the United States have assumed large proportions. In November and December, 1955, at the request of the Department of State, the Society provided escort for two Russian engineers in the country to study automation, and advised the State Department in the selection of three ASME members to visit Russia on a like mission. In May, 1956, the Society was represented by a delegation at the Centennial of the Verein Deutsche Ingenieure in Berlin. Active participation was given by large ASME representations in the meetings of the World Power Conference in Vienna, the International Electrotechnical Commission in Munich, both in June, and the International Congress on Applied Mechanics in Brussels in September, 1956. In London, with the co-operation of The Institution of Mechanical Engineers, the Society sponsored the Fifth International Conference on Steam Properties, which was

field of service and how, through its efforts, great strides have been made in conservation of resources are explained in the paper.

Impact of Atomic Energy on Fossil Fuels, by R. C. Dalzell, Mem. ASME, Engineering Development Branch, Atomic Energy Commission, Washington, D. C., and Harry Perry, Division of Bituminous Coal, U. S. Department of the Interior, Bureau of Mines, Washington, D. C. 1956 ASME Joint Solid Fuels Conference paper No. 56—FU-7 (multilithographed; available to August 1, 1957).

SINCE the initial applications of nuclear reactions to military use, the United States has made a concentrated effort to develop peaceful applications for this enormous energy reserve. Any new source of energy can be expected to exert some effect upon our total economy and upon the fossil-fuel industries, which have supplied the bulk of the energy in the past. Studies indicate that for the next 20 years the greatest effect of nuclear fuel will be on the fossil-fuel markets for power generation.

The most obvious potential use of controlled nuclear reactions is for generating electricity. Intensive research efforts in this direction, both in the United States and abroad, have resulted in a number of reactor types, and some of them have been installed in prototype plants. On a smaller scale, research is also under way on the applications of nuclear energy in other fields which may have an impact on the fossil-fuel industries. The more important of these include the propulsion of ships and aircraft, use in process and space heating, and a more recent development aimed at using nuclear energy to supply the heat for high-temperature endothermic reactions.

ASME Transactions

THE December, 1956, issue of the Transactions of the ASME, which is the *Journal of Applied Mechanics* (available at $1 per copy to ASME members, $1.50 to nonmembers) contains the following:

Technical Papers

A New Method of Analyzing Stresses and Strains in Work-Hardening Plastic Solids, by William Prager. (56—APM-34)

Three "Neutral" Loading Tests, by S. S. Gill. (56—APM-18)

A Method for Determining the Flexural Effects of Statically Loaded Beams on Multiple Elastic Supports, by R. A. Di Taranto. (56—APM-24)

The Effect of Shear on the Plastic Bending of Beams, by D. C. Drucker. (56—APM-28)

Impulsive Loading of Elastic-Plastic Beams, by J. A. Seiler, B. A. Cotter, and P. S. Symonds. (56—APM-17)

The Mathematical Analysis of Bow Girders of Any Shape, by M. M. Abassi. (56—APM-23)

Thermal Stresses in Infinite Elastic Disks, by Brahmadev Sharma. (56—APM-19)

Influence of Large Amplitudes on Free Flexural Vibrations of Rectangular Elastic Plates, by Hu-Nan Chu and George Herrmann. (56—APM-27)

On the Transmission of a Concentrated Load Into the Interior of an Elastic Body, by G. L. Neidhardt and Eli Sternberg. (56—APM-35)

On the Stresses in a Strip Under Tension and Containing Two Equal Circular Holes Placed Longitudinally, by A. Atsumi. (56—APM-12)

Three-Dimensional and Shell-Theory Analysis of Axially Symmetric Motions of Cylinders, by George Herrmann and I. Mirsky. (56—APM-32)

Effect of Imperfections on Buckling of Thin Cylinders Under External Pressure, by L. H. Donnell. (56—APM-39)

Minimum Weight Design of Cylindrical Shells, by Walter Freiberger. (56—APM-33)

The Tapered-Land Thrust Bearing, by C. F. Kettleborough. (56—APM-21)

The Sector-Shaped Pad, by C. F. Kettleborough. (56—APM-22)

The Boundary Layer Inside a Conical Surface Due to Swirl, by H. E. Weber. (56—APM-31)

A Theory for Base Pressures in Transonic and Supersonic Flow, by H. H. Korst. (56—APM-30)

On the Torsional Oscillations of a Solid Sphere in a Viscous Fluid, by G. F. Carrier and R. C. Di Prima. (56—APM-29)

An Experimental Investigation of Beam Stresses Produced by Oblique Impact of a Steel Sphere, by D. M. Cunningham and Werner Goldsmith. (56—APM-41)

Kinematic Phenomena Observed During the Oblique Impact of a Sphere on a Beam, by Werner Goldsmith and D. M. Cunningham. (56—APM-40)

The Influence of Blast Characteristics on the Final Deformation of Circular Cylindrical Shells, by P. G. Hodge, Jr. (56—APM-25)

Axisymmetrical Buckling of Circular Cones Under Axial Compression, by Paul Seide. (56—APM-36)

Electronic Analog Computer Solutions of Nonlinear Vibratory Systems of Two Degrees of Freedom, by C. P. Atkinson. (56—APM-38)

Transient Response of a Nonlinear System by a Bilinear Approximation Method, by E. I. Ergin. (56—APM-37)

Design Data and Methods

Brief Notes

Discussion

On previously published papers

Book Reviews

ASME Papers Order Form

Copies of ASME technical papers digested this month are available in pamphlet form. Please order only by paper *number;* otherwise the order will be returned. Orders should be addressed to the ASME Order Department, 29 W. 39th St., New York 18, N. Y. Papers are priced at 25 cents each to members; 50 cents to nonmembers. Payment may be made by check, U. S. postage stamps, free coupons distributed annually to members, or coupons which may be purchased from the Society. The coupons, in lots of ten, are $2 to members; $4 to nonmembers.

Note: No digests are made of ASME papers published in full or condensed form in other sections of MECHANICAL ENGINEERING.

Copies of all ASME publications are on file in the Engineering Societies Library and are indexed by the Engineering Index, Inc., both at 29 West 39th Street, New York, N. Y.

ASME Transactions and the *Journal of Applied Mechanics* are on file in the main public libraries of large industrial cities and in the technical libraries of engineering colleges having ASME Student Branches.

ASME Order Department
29 W. 39th St.
New York 18, N. Y.

Date.....

Please send me the papers indicated by the following circled numbers:

56—PET-5	56—LUB-3
56—PET-7	56—LUB-4
56—PET-8	56—LUB-5
56—PET-12	56—LUB-6
56—PET-13	56—LUB-7
56—PET-17	56—LUB-8
56—PET-22	56—LUB-9
56—PET-24	56—LUB-10
56—F-21	56—LUB-11
56—IRD-19	56—FU-1
56—IRD-20	56—FU-2
56—IRD-21	56—FU-3
56—IRD-22	56—FU-4
56—IRD-23	56—FU-5
56—LUB-1	56—FU-6
56—LUB-2	56—FU-7

Name.....

Address.....

City.....State.....

☐ Remittance enclosed ☐ Bill me

☐ ASME Mem. ☐ Nonmem.

Table 1 1955–1956 Meetings and Conferences

Meetings and Conferences	Days	Sessions	Papers	Preprints	Attendance
ASME-ASLE Lubrication Conference Oct. 10–12, 1955, Indianapolis, Ind.	3	6	27[1]	26	262
ASME-AIME Solid Fuels Conference Oct. 19–20, 1955, Columbus, Ohio	2	2**	6	4	300
Diamond Jubilee Annual Meeting Nov. 13–18, 1955, Chicago, Ill.	5	107	262	219	4835
Aviation Conference March 14–16, Los Angeles, Calif.	3	20	42	30	1004
Engineering Management Conference March 14–16, 1956, St. Louis, Mo.	2	4	12	3	206
Spring Meeting March 18–21, 1956, Portland, Ore.	3	18	43	22	285
Instruments & Regulators Conference March 26–28, 1956, Princeton, N. J.	3	6	18	18	253
Oil Gas Power Conference April 1–5, 1956, New Orleans, La.	4	7	8	8	558
Machine Design Conference April 10–11, 1956, Worcester, Mass.	2	4	5	4	201*
Gas Turbine Power Conference April 16–17, 1956, Washington, D. C.	3	6	17	17	787
Management-SAM Conference April 26–27, 1956, New York, N. Y.	2	4**	6	[2]	1261
Metals Engineering-AWS Conference May 8–11, 1956, Buffalo, N. Y.	5	4**	8	6	227
Design Engineering Conference May 14–17, 1956, Philadelphia, Pa.	4	4	4	[2]	1263
ASME-EIC Meeting May 23–25, 1956, Montreal, Can.	3	[3]	8	3	125
Applied Mechanics Western Conference June 11–13, 1956, Pasadena, Calif.	3	6	19	6	100
Applied Mechanics Conference June 14–16, 1956, Urbana, Ill.	3	8	35	35	280
Semi-Annual Meeting June 17–21, 1956, Cleveland, Ohio	4	44	86	72	1288
Fall Meeting Sept. 10–12, 1956, Denver, Colo.	3	14	28	22	325
IRD-ISA Conference Sept. 17–21, 1956, New York, N. Y.	5	2**	5	5	200*
Petroleum Conference Sept. 23–26, 1956, Dallas, Tex.	3	20	34	33	900*
	65	286	673	533	14,660

* Estimated.
** ASME Sessions.
[1] All preprints were prepared by ASME.
[2] All papers were included in Proceedings.
[3] ASME's participation consisted of individual papers.

permits the illustrations to be included near the pertinent reading matter. Of the packages of 10 coupons given to each member, 13.6 per cent of the 1954 series and 14.1 per cent of 1955 series were redeemed for technical papers.

At his own request, John M. Lessells was relieved of the assignment as Technical Editor of the *Journal of Applied Mechanics* and, during the summer, D. C. Drucker and J. Kestin assumed the task and the additional one of supervising the review procedure for the Applied Mechanics Division.

An innovation occurred in the issue as an Annual (AM5) for free distribution on request by members of the complete "Indexes to ASME Papers and Publications" which includes a listing of the 275 special publications on the ASME shelves for sale, a list of papers not published which are bound and filed in the Engineering Societies Library, and indexes of Transactions, including *Journal of Applied Mechanics* and MECHANICAL ENGINEERING.

Three volumes of the Metals Engineering Handbook Series are now published, the volume of Engineering Tables appearing in April, 1956. Metals Properties was reprinted in December, 1955, and Design in August, 1956. The final volume in the Series on Processes will appear in 1957.

Applied Mechanics Reviews doubled the subscription rates without substantial effect on the circulation and appeared in a new less-expensive offset format, both of which bettered the financial position of the periodical and reduced somewhat the need for government subsidy.

Published codes, standards, research reports, and other miscellaneous publications were shipped at the annual rate of about 100,000 copies. About the same number of technical papers were sent out, in addition to the Society periodicals.

Advertising and publication-sales income increased about 20 per cent in comparison to the previous year.

Professional Divisions

As reported previously, three Professional Divisions joined the list of those holding annual conferences, bringing the total to 11. Three additional Professional Divisions perfected their plans to hold conferences in 1956–1957. All the Professional Divisions contributed sessions to one or more national meetings.

Progress was made in the organizational relationships between Professional Divisions and with other Society activities. The concept was adopted that registration by a member in a field of interest of a Professional Division did not constitute "Membership" in that Division because every Society member is free to participate in all Division activity.

The Model By-Laws for Divisions were revised and budgeting procedures for Division operations clarified.

Lectureships

Six distinguished engineers and scientists appeared before 47 Sections and Student Branches and were enthusiastically received. An expanded program is now planned for 1956–1957.

ASME Research

Of the seventeen Society research committees extant, five (Metals Processing, Condenser Tubes, Elevators, Mechanical Springs, and Automatic Regulation Theory) have no research projects presently in operation. Mechanical Springs is in the process of reorganization, and Automatic Regulation Theory is being studied with a similar approach in mind.

Good progress in its various projects has been reported by the Joint ASTM-ASME Committee on the Effect of Temperature on the Properties of Metals. High Temperature Steam Generation has completed the installation of its apparatus at the Philip Sporn Plant of the American Gas and Electric Company System and tests have begun. The Committee is also planning another financial campaign to raise $190,000 in order to complete the program which is expected to run three more years. The Fluid Meters Committee is continuing its research on pulsation flow at both low and high Reynolds numbers and the effect of installation on meters. In addition, four members of Fluid Meters attended the meeting of ISO/TC/30 on Measurement of Fluid Flow that was held in Munich last summer. Properties of Steam, a new program begun last year, now has experimental work being done on five different proj-

attended by the President. Also in London, the Society co-operated with the Institution in an International Conference on Fatigue and will co-operate further by re-presenting the papers at the 1956 Annual Meeting.

Co-operation with The Engineering Institute of Canada is always good, but this year was significant because ASME joined EIC in its annual meeting in Montreal and, as the year closes, has completed plans for participation in a joint meeting on education in London, Ontario.

The Society was honored to have as the 1956 Calvin Rice Lecturer at Cleveland, Dr. D. F. Galloway, Director of Research of the Production Engineering Research Association of England. Dr. Galloway also gave a paper at Cleveland and lectured at the ASME-EIC meeting.

As dealt with later, the Society participated in four important meetings on codes and standards, one in Madrid and three in Munich.

Society Honors

At the present time the Society administers 19 honors and awards, in addition to honorary memberships. The recent increase in this program, with three honors added in 1955 and the heavy staff load the program entails, prompted the Council to appoint a committee, which presented its recommendations at the Cleveland Council Meeting. The recommendations which were adopted provided for more representative membership of the Medals Committee and the Board on Honors and set higher standards for honor administration.

Aims and Objectives

The 75th Anniversary year seemed an appropriate time for the Society to review its aims and objectives and set a goal for future progress. This project was assigned to the Organization Committee which presented its first findings at the Chicago meeting. The report, compiled after collecting views of many members active in many walks of Society life, was a strong confirmation of the basic aims of the Society but contained differing opinions as to the proper ways to improve the implementation of the aims. It became evident that a long-range study program is necessary and the Organization Committee spent time on this during the year. One step accomplished was the review and codification of existing Council policies.

The Technical Life of ASME

The Board on Technology is responsible for stimulating and co-ordinating the activities that promote the technical life of the Society, through national meetings, Professional Divisions conferences, publications, and research. The Board also supervises special projects in its general area of competence. These include the Metals Engineering Handbook, *Applied Mechanics Reviews*, Air Pollution Controls, and Lectureships. Two new projects were added during the year. A Solar Energy Application Committee was appointed to maintain cognizance of scientific and engineering development in solar energy and assure appropriate ASME participation. A second committee was appointed on Technical Development to review new scientific and engineering knowledge, anticipate the need for technical activity in new fields, and recommend the form of ASME activities to meet the new needs.

One potent method of co-ordinating the work of the Board is the annual Technology Executives' Conference. The 1956 Conference at Ann Arbor in January brought together about 80 members of the Board, the subsidiary standing committees, Professional Divisions executive committees, research committees, and staff for two days' discussion of the activities of each group.

The primary problem of the Board relates to the ever-increasing number of meetings and papers and the consequent increase of publications load—all against rising costs for all services. Progress is being made in improving quality of the papers presented by instituting more thorough methods of review and securing better adherence to deadlines for having the papers in the hands of reviewing agencies. Much remains to be done.

Meetings

The brilliant Annual Meeting in Chicago in November, 1955, the final event in the celebration of the Diamond Jubilee year, was highlighted by two interesting panel discussions on the "Economic Aspects of Technology" and "The Engineer and the World of Commerce and Industry." The panel participants were the recipients of joint awards and ASME honorary memberships. Several events reflected the warm hospitality of the Chicago members. There was the usual wealth of technical papers presented in 107 sessions.

Table 1 gives the data on the 20 national meetings and Division conferences during the year. Three Professional Divisions appeared on the list for the first time with independent conferences and are planning subsequent meetings. The Design Engineering conference, in conjunction with an exposition, with the program sponsored by the Machine Design Division, proved to be a very successful innovation and is to be continued.

The attendance at the Annual Meeting was 1800 less than the previous year, but the session attendance seemed better than in 1954.

In addition to these national affairs, the 85 Sections held 1366 meetings, the 142 Student Branches held 679 meetings, and there were 12 Regional Student Branch conferences with a total attendance of over 2000 students and faculty members.

Publications

During the year the Publications Committee made useful progress in the principal problem it faces: the control in quantity and quality of the increasingly unwieldy volume of material that flows from meetings for publication.

Transactions and the *Journal of Applied Mechanics* published 2476 pages of technical material and made a substantial reduction in the backlog of unpublished material which is now approaching a normal backlog. The policy for depositories of Transactions in the United States, Canada, and Mexico was modified to provide for placing the volumes in the libraries where they are needed and properly cared for.

During the year, 1178 pages of text were printed in MECHANICAL ENGINEERING, the format and readability of which were further improved. The policy of condensing articles to provide more articles and broader coverage was continued without serious objections.

Of the 673 technical papers presented during the year, 533 were prepared in advance of the meetings, the majority in the new two-column multilith format which

adopted and ordered circulated for incorporation in 1957 in the international rules with other modifications.

IEC/TC/5 on Steam Turbines agreed on specifications for issue as an international document and considered suggested rules for acceptance tests.

ISO/TC/30 on Measurement of Fluid Flow considered favorably requests of the representatives of the ASME Fluid Research Committee that the code be modified to permit inclusion of American standards. The next meeting is planned for New York when the documents are ready for consideration.

In connection with the ASME program of Research in Properties of Steam, a Fifth International Conference was held in London in July, 1956, and attended by representatives from nine countries that are engaging in steam-properties research. The primary purpose of the Conference is to work toward an acceptable international skeleton table of properties. Satisfactory progress was reported.

No meetings were held on the ABC (Canada, Great Britain, and U.S.A.) program of unification of engineering standards, but a large amount of work was done and some documents interchanged, principally on drafting practice.

Education and Professional Status

The Board on Education and Professional Status coordinates the education, training, and growth activities of the Society. For the time being the Board has jurisdiction over consulting engineering practice.

The Education Committee has continued its interest in supporting the accrediting process of engineering curricula by Engineers Council for Professional Development, This interest was demonstrated by reviewing the list of ASME representatives on delegatory committees and in preparing an orientation seminar for them.

The Engineers Registration Committee continued its program to inform students and members about registration and particularly about the importance of the Engineer-in-Training examinations and procedures.

The National Junior Committee works as a staff committee developing ideas implemented at various levels by which recent graduates are brought into closer contact with the Society. The year's work was evidenced by sessions at national meetings on developing the young engineer professionally, in the Junior Forum in MECHANICAL ENGINEERING, and in the increased number of junior advisers to national and local committees.

The Special Committee on the Professional Practice of Consulting Engineering brought to publication stage a Manual of Practice for Consulting Engineers and a Directory of Consulting Engineers and secured Council approval of a procedure for dealing with violations of the Society policy on publicly advertising for bids. This committee represents ASME on the EJC-ECPD Joint Committee on the Practice of Engineering and on the EJC Task Committee on Consulting Practice.

Membership

Table 3 shows the membership at the end of the year, compared to the previous year.

The Board on Membership co-ordinates activities on admissions, review of special cases, and development.

During the year, a change in admission procedure was instituted to improve the choice of references by the applicant and reduce the delay in hearing from references. Membership development literature and procedures were improved.

The Admissions Committee made 3606 recommendations for membership and the Membership Review Committee considered 898 special cases.

Society Activity in the Regions

The services available to the members through the 85 Sections and to students through the 142 Student Branches have been organized since 1945 in eight Regions, each with a vice-president who is a member of the Council. The vice-presidents meet with the president three times a year to co-ordinate their activities and to consider problems that require Council action.

The outstanding innovation of the year was the new student plan adopted by the Council in June, 1956, to take effect in the fall of 1956. Incorporated in the plan are a number of procedures designed to improve the Student Members' contact with the Society and some increased services, including 12 issues of MECHANICAL ENGINEERING a year (instead of 8 as at present), a book of five coupons that may be exchanged for technical papers, and a student pin. Student dues are increased from $3 to $5. The designation "Student Branch" is to be changed to "Section." The basis for the new plan is the concept that Student Members are truly members of the Society in all respects.

Each vice-president presents an annual report to the Council, transmitting reports of the Regional Committees and of the Sections in the Region. The reports, which are embodied in the annual book of reports, give an astonishing picture of fruitful activity by hundreds of members working on committees in the Regions.

All of the Regional reports stressed the splendid success of the Student Branch conferences, twelve of which are held each spring at which representatives of the Student Branches present papers and discuss improved Branch operations. The quality of presentation is

Table 3 Changes in Membership—Sept. 30, 1955, to Sept. 30, 1956

	Membership		Increases			Decreases				Changes		
	Sept. 30, 1956	Sept. 30, 1955	Transferred to	Elected	Reinstated	Transferred from	Resigned	Dropped	Died	Increases	Decreases	Net Change
Honorary	74	73		3					2	3	2	+ 1
Fellows	407	408	20			2			19	20	21	− 1
Members	14944	14538	295	473	131	22	161	175	135	899	493	+ 406
Affiliates	290	301	8	6			13	6	6	14	25	− 11
Associate Members (25)	4357	3810	692	156	85	149	62	169	6	933	386	+ 547
Associate Members (20)	6177	4497	2803	145	39	841	144	314	8	2987	1307	+1680
Associate Members (10)	15387	16832		2313	42	2806	218	766	10	2355	3800	−1445
Total	41636	40459	3818	3096	297	3820	598	1430	186	7211	6034	+1177

ects at three laboratories. Moreover, it has had considerable success in its financial campaign to raise $375,000 for its three-year program. In addition to the major financial support Steam Properties is receiving from American firms, the Committee has received nominal contributions from four European companies. As part of the Steam Properties program, the Fifth International Conference on the Properties of Steam was held in London last July with ten delegates from the United States in attendance, including ASME President J. W. Barker. (The Society is acting as International Secretariat for these conferences.) Heat Conduction Charts has completed the first phase (Rate of Temperature Change of Simple Shapes) of its seven-part program and is now continuing with the second phase (on cylinders). Mechanical Pressure Elements has completed the first part of its project on Bourdon tubes and is now beginning a financial campaign to raise $20,000 in order to carry on the second part—laboratory experiments on the accuracy of pressure-deflection measurements. This committee is also formulating a research program on diaphragms. Lubrication is continuing its work on dynamically loaded bearings and is planning another program on the effects of pressure viscosity characteristics of lubricants on the lubrication of machine elements. Boiler Feedwater Studies has completed its reorganization as an ASME committee, a change from its joint status with five co-operating bodies, and is now preparing a financial campaign for funds to underwrite several proposed research projects. Furnace Performance Factors has completed its correlation of past results and has begun installation of equipment for a full-scale, furnace test. Corrosion and Deposits from Combustion Gases has begun soliciting $40,000 to finance a survey of present research in this field preparatory to the initiation of experimental work. Engineering Administration is continuing its revision of a book on the subject, and publication is expected sometime next year. Thermal Conductivity of Gases is beginning reconstruction and calibration of its equipment after redesigning it for improved accuracy. Plastic Flow of Metals is held up in its publication of the final report on the rolling of metals because of the lack of necessary funds to cover the cost of printing.

Further progress was made in encouraging the Professional Divisions to take a more active part in proposing new research projects suitable for sponsorship and administration by ASME. As a result, two new research programs were approved, and the formation of two new committees to carry out these programs was authorized: one on the Flow of Bulk Materials and the other on the Prevention of Fracture in Metals.

A brief financial summary of ASME research activities for the fiscal year 1955–1956 is given in Table 2. Research expenditures for the year totaled $161,460 as compared with $54,000 for last year. These monies were contributed by The Engineering Foundation and by industry. As of Sept. 30, 1956, the Custodian Account contained $94,735 earmarked for the continuance of current projects and for further research programs.

Table 2 Major ASME Research Expenditures, 1955–1956

	Expenditures 1955–1956	Balance in custodian account 9/30/56
Fluid Meters	$ 2515.94	$ 2271.28
Effect of Temperature on Properties of Metals	7179.00	34,334.39
High-Temperature Steam Generation	54,510.38	27,778.16
Furnace Performance Factors	3200.00	4570.24
Heat-Conduction Charts	14,740.57	1812.50
Engineering Administration	3725.00	665.21
Properties of Steam	72,828.60	10,138.43
Properties of Gases	2500.00	2848.95

Air-Pollution Control

Two reports were published and distributed widely, one on air-pollution instruments, the other on air-pollution research projects. Preparation of a third report on control equipment was initiated. A research project on sulphur stack gases has been formulated for implementation under the ASME research program. The Committee sponsors "Smog News," a bimonthly collection of clippings from the daily press on smog and smog control.

ASME Codes and Standards

The ASME Codes and Standards program utilizes the services of about 3800 engineers for the 60 projects for which ASME takes responsibility. 1955–1956 was a productive year, with the publication of 1956 editions of four codes under the Boiler and Pressure Vessel Committee, 16 standards and four reprints under the procedures of the American Standards Association, two standards on ASME responsibility, and one ASME Power Test Code.

ASA has established a Nuclear Standards Board on which ASME is represented. ASME has accepted sponsorship of projects on Automatic Control Terminology, Plumbing Equipment, and Automatic Parking Garage Equipment.

Foreign interest in American industrial practice led to the formulation of a policy under which Society codes and standards may be translated into foreign languages.

The ASME Pressure Vessel Code has been broadened and improved so that it now more nearly covers the petroleum industry's needs; consequently, by agreement between API and ASME the joint Code as a publication and a service is to be discontinued in December, 1956.

International Programs of Research, Codes, and Standards

The technical responsibility of ASME is expanding internationally at a rapid rate. During the year five important meetings for which ASME had prime responsibility were held in Europe.

The Boiler and Pressure Vessel Committee holds the secretariat for ASA of ISO/TC/11, a technical committee of the International Organization for Standardization dealing with international rules for construction of boilers. The second plenary session of ISO/TC/11 in Madrid in February, 1956, was attended by 130 delegates from 16 countries and great interest was displayed in an international set of rules.

Three important meetings were held in Munich in July, 1956, during the session of the International Electrotechnical Commission as follows:

IEC/TC/4 on Hydraulic Turbines was attended by thirty delegates from nine nations. The flow-measurement methods in the ASME Power Test Code were

ment executive agencies in developing sound administration of legislation affecting the education and utilization of engineers.

Committee on International Relations. As the operating agency of EJC on international engineering matters, the Committee was represented at the VDI Centennial in Berlin in May, at the World Power Conference in Vienna in June, and at the Fifth International Conference on the "Properties of Steam" in London in July.

UPADI. The Fourth UPADI Convention was held in Mexico City, October 8–12, 1956, with the Presidents of ASME and ASCE and many other prominent U. S. engineers in attendance. "Improvement of Engineering Education in the Western Hemisphere" was the main subject for discussion at the round table during the Convention. An arrangement for the exchange of information of mutual interest between EUSEC and UPADI was set up with the Committee as the link between the two international organizations.

UNESCO. During 1957 UNESCO will hold a conference on "The Engineer in the Atomic Age" which will consider problems relating to the scientific and technological training of engineers and research workers specializing in the field of nuclear energy.

Co-operation With National Bureau of Standards

The ASME Technical Advisory Committee to the National Bureau of Standards, established in 1954, held a two-day meeting at the Bureau in December, 1955, with the ASCE Committee. The Committee's functions include advising the Bureau on specific problems and suggesting new fields of study by the Bureau. The Committee's primary concerns are the Heat and Power, Mechanics, Optics, and Metrology Divisions of the Bureau.

Co-operation in Education and Training

Engineers Council for Professional Development (ECPD)

The program of ECPD deals with the career of the young man from the time he decides to enter engineering until he is recognized as having attained engineering stature. In addition, ECPD is delegated by five of its member societies to represent them in the Education and Training Conferences sponsored by the Conference of Engineering Societies of Western Europe, and U.S.A. (EUSEC), the next of which will be in Europe in 1957.

The ECPD-EJC Committee completed its proposal for a study of the engineering profession.

The work of ECPD is performed by its standing committees whose activities are summarized as follows:

The Guidance Committee is concerned with counseling and guiding prospective engineering students while in secondary school. The Committee mailed 35,000 information folders to all the secondary public and parochial schools with gratifying response. A new guidance manual was prepared for the use by engineers who counsel young people.

Guidance-counselor workshops were held in connection with summer college programs. 30,000 copies of "Engineering—A Creative Profession" were distributed in twelve months.

The Accreditation Committee made inspections of 233 curricula in 72 institutions. The 1955 statements of "Additional Criteria for Accreditation" which were adopted as guiding principles rather than arbitrary specifications have given rise to a number of requests for interpretation. Co-operation with regional accrediting associations has continued to develop.

The Student Development Committee prepared an outline for a seminar on professionalism given at the University of Tennessee. A subcommittee is studying drop-outs in engineering programs, a timely project in view of the present shortage of engineering graduates.

The Training Committee, which is charged with the postcollege training of graduates, has placed major emphasis on the new project in Detroit and the continuation of the old one in Cincinnati during the current year.

In Detroit a meeting of local industry was held to discuss the first of the six points of "The First Five Years of Professional Development—Orientation and Training." A similar meeting was held for the young engineers. Booklets on Orientation and Training, Continued Education and Professional Identification have been prepared and distributed to Detroit industry. Similar booklets will be issued, dealing with Integration into the Community and Selected Reading.

The Reading List for Engineers is now ready in the inexpensive edition for sale; the Detroit edition to match their other brochures will be ready shortly.

A committee has been formed in Minneapolis, and the next six months should see action in this group in furtherance of the program.

The Ethics Committee was charged by the Executive Committee to foster the following program:

1 To hold open sessions during annual meetings exerting influence upon constituent and other engineering societies to hold sessions on ethics.

2 Arranging for the publication of articles and papers in the field of ethics in journals.

3 The publication of a suitable brochure to contain the canon and codes or regulations for professional practice and the publication of pamphlets or handbooks on ethical procedure for the various groups of engineers and employers.

The committee has outlined the above long-range program and has made progress in its attainment.

The Recognition Committee has made suggestions on the revision of the California Registration Law and on the proposed change in the New York Licensing Law.

Co-operation in Advancing Engineering Science

Engineering Societies Library. A collection of 173,000 volumes, 1400 current periodicals in a score of languages, and a photoprint, microfilm, translation, and search service were used by over 40,000, half of whom submitted inquiries by mail, telephone, and telegraph. The Library sponsors Engineering Societies Monograph Service which approved one manuscript on Engineering Analysis for publication.

The Engineering Foundation, in the furtherance of research, supported the following ASME projects:

During the past ten years the Foundation contributed $81,150 in support of ASME projects. It has also been an important contribution to ECPD since its founding in 1932.

International Organization for Standardization is mentioned under "International Programs of Research, Codes, and Standards."

International Electrotechnical Commission held its

always remarkably high, setting a standard more experienced speakers would do well to study and emulate. An important and dramatic innovation this year was the bringing together at Cleveland of the winners in the 12 Conferences from whom the national winner was selected. The national winner will appear at the Annual Meeting and receive a Special Prize of $150. All expenses for this competition were borne by the Old Guard (dues-exempt members). A number of Sections reported giving increased attention to the specialized needs of the members. Cincinnati reported a successful multiple-interest meeting starting with one gathering that split into four separate simultaneous discussions on specialized topics. Several Sections reported decentralized meetings. In general, brisk and stimulating activities in the Sections were revealed. Close relations between Sections and nearby Student Branches were evident in a number of Regions, but Kansas City did a noteworthy thing in holding two-day counseling sessions for each of the two Student Branches in its area. The Society film "To Enrich Mankind" was used at Section, Student Branch, and general gatherings throughout all the Regions. Five Sections on the Pacific Coast conducted brush-up courses for those taking licensing examinations.

Student Branches were activated at Youngstown and Ohio Northern Universities.

The Olean (N. Y.) and Central Kansas Sections were established. Sub-Sections were set up in Santa Clara Valley (Calif.), Northeast Florida, Richmond (Va.), and Tarrant County (Texas). Groups were activated in Johnstown (Pa.), Northwest Florida, and Baton Rouge (La). The name of the Plainfield Section was changed to the Mid-Jersey Section.

In each Region, at the Regional Administrative Committee meeting, two representatives of each Section met with the vice-president, the Regional Committees, and staff to promote Society activities and to discuss a National Agenda of items suggested by members designed to improve Society operation. Representatives of each Region met in Cleveland in June to consolidate the regional views on the National Agenda, presented the findings to the Council and referred them to the responsible committees. Council will review the results and report back early in 1956–1957. There were 35 items on the National Agenda discussed in the Regions and 10 recommendations were made to the Council at Cleveland. These recommendations dealt with (*a*) National Nominating Committee; (*b*) comments on controversial issues submitted to the members for ballot; (*c*) backlog of unpublished papers; (*d*) reports of Professional Divisions; (*e*) formulation of a new Division; (*f*) unity of the profession; (*g*) encouraging members to become licensed.

ASME Co-operation

As many activities in which ASME members are interested are activities in which other engineering society members are interested, close collaboration between societies being of fundamental importance. ASME takes just pride in its time-tested policy of working with other engineering groups on common problems. Joint activities are therefore ASME programs worked on by ASME members, and good performance in them is a matter of real pride to ASME.

Progress in co-operative efforts is reported as follows under the purposes of the co-operation.

Co-operation in the Public Interest

Engineers Joint Council

EJC Growth. The American Society of Heating and Air Conditioning Engineers became a constituent member and the American Society of Agricultural Engineers an associate member. The Los Angeles Council of Engineering Societies and the Kentucky Society of Professional Engineers became affiliates.

General Assembly. The second General Assembly of EJC was held on January 26–27, 1956, with a registration of approximately 500 people. Sessions were devoted to: Review of the Reserve Forces Act of 1955; Utilization of Engineers and Engineering Technicians in Balanced Teams; and the Engineering Aspects of the Hoover Commission Reports. The third Assembly, scheduled for January, 1957, will deal with current problems of the engineering profession.

Nuclear Engineering and Science Congress. The first Congress was held in December, 1955. Twenty-four national engineering and scientific societies participated with a total of 252 technical papers covering the entire nuclear field. The registration at the Congress exceeded 2700. The Atomic Exposition held in conjunction with the Congress drew an attendance of over 13,000.

The second Nuclear Engineering and Science Congress has been scheduled for March, 1957, in Philadelphia, Pennsylvania.

National Water Policy Panel. At the suggestion of the Panel, a Review Board was established, charged with preparing an adequate summary of the changes in the national water policy since publication of the EJC report in 1951. This summary was received by the EJC Board in September, 1956.

Employment Conditions. The report of the Committee entitled "Professional Standards and Employment Conditions" was accepted by the Board in March, 1956, and distributed to the societies for publication in their journals. Six societies published the report in full, with abstracts or references being made to it by other society journals. In addition, the report was published in separate booklet form in answer to requests from individuals and companies. A circulation of over 7000 copies of the booklet have been made, in addition to reprints from the Society journal publications.

Special Surveys. The annual Demand Survey, prepared in co-operation with the Engineering Manpower Commission, indicated the continued shortage of qualified engineering graduates. The triannual Salary Survey is being conducted this year. The results are expected to be available in January, 1957.

Practice of Engineering. EJC has established a joint committee with ECPD to study the question of the practice of engineering as it concerns individuals, partnerships, and corporations. Detailed reports will be presented to the EJC Board in this coming year.

Consulting Practice. In co-operation with several of the societies, EJC is acting as liaison in the establishment of a consulting practice manual for general use of the engineering profession. Drafts of this manual prepared by groups from three of the societies are being utilized in the preparation of the final manual.

Engineering Manpower Commission. The EMC presented expert testimony for the use of congressional committees concerned with legislation which ultimately became the Reserve Forces Act of 1955. The work of EMC is being continued by assisting responsible govern-

policy and watches income and expenditures. A following document gives their report.

Organization Committee is charged with maintaining the effectiveness of the committee structure and personnel and by special action of the Council with review of society aims and long-range objectives.

Constitution and By-Laws Committee watches over Society law. Presently as a special task, it is working on a method of codifying Society policies as adopted by the Council.

Pension Committee supervises the employees retirement plan.

Public Relations Committee guides the Society public-relations program.

Council Committee on Staff Personnel advises the Council and the Secretary on major problems of the staff organization.

Record of the Council, the President, and the Secretary's Office

Council and Vice-Presidents' Meetings. The Council met twice during the fiscal year, at the Annual Meeting in Chicago, Ill., November 13–14, 1955, and in Cleveland, Ohio, June 16, 18, 1956. Meetings of the Vice-Presidents were also held during those meetings, and a third one, at Society headquarters, on February 24–25, 1955. The Executive Committee of the Council held nine meetings.

President's Visits. At the close of his administrative year in November, 1956, the President will have addressed 26 Sections and 13 Student Branches in addition to his appearances at five national meetings, eight Professional Division Conferences, the Nuclear Engineering and Science Congress, the ASME Technology Executives Conference, the EJC General Assembly, the Annual ASME Vice-Presidents Conference, the Kettering Award Luncheon, and the Winter Meeting of AIEE. He addressed groups of business leaders in Kansas City, Spokane, and Dallas, and the Professional Engineers of Oregon at Portland.

The President represented the Society at the ASME-EIC Joint Meeting in Montreal, the ASME-EIC Education Conference in London, Ontario, the Fifth International Conference on the Properties of Steam in London, England, and the Pan-American Federation of Engineering Societies in Mexico City.

Deaths. During the fiscal year, the following deaths were recorded:

Ely S. Hutchinson, Manager, 1928–1931, Vice-President, 1933–1935, died Nov. 12, 1955.

H. P. Liversidge, Manager, 1921–1924, died Dec. 8, 1955.

E. B. Ricketts, Vice-President, 1940–1942, died Jan. 8, 1956.

Thomas L. Wilkinson, Vice-President, 1924–1926, died March 27, 1956.

Elliott H. Whitlock, Vice-President, 1933–1935, died July 4, 1956.

W. J. Wohlenberg, Vice-President, 1942–1944, died Aug. 8, 1956.

H. C. Boardman, Chairman, Boiler and Pressure Vessel Committee, died Aug. 6, 1956.

Sir Henry Guy, Fellow ASME, former Secretary, The Institution of Mechanical Engineers, died July 20, 1956.

Ralph S. Damon, 1955 recipient of the Spirit of St. Louis Medal, died Jan. 4, 1956.

Mrs. Calvin W. Rice, widow of Calvin W. Rice, Secretary of the Society, 1906–1934, died March 1, 1956.

Harvey Mack, of Mack Printing Company, publishers of the Society's publications for many years, died May 29, 1956.

It is with deepest regret that the death, on Aug. 16, 1956, of Katherine W. Clendinning is reported. She was Managing Editor and associated with the Society for almost forty years.

Secretary's Staff. John Reid was added to the staff during the year as Research Manager, and L. S. Dennegar as Public Relations Director. F. S. Mallette relinquished his duties as Research Manager and became part-time secretary of Air Pollution Controls Committee.

C. E. Davies, Marie J. Mullan, Leslie Scanlan, and Benjamin Theroux have completed 35 years of service with the Society, and Jeannette M. Meyer has completed 30 years.

Committee Reports

The reports of the Council from committees and delegates to joint bodies, from which this report was compiled, are published in a pamphlet which is distributed at the Business Session when this report is presented and is available to others on request. They form an inspiring record of the work of hundreds of individuals who have worked hard to support a great Society in its important activities on a broad front.

1955–1956 Council

President: Joseph W. Barker

Past-Presidents

Frederick S. Blackall, Jr.
Lewis K. Sillcox
David W. R. Morgan

Vice-Presidents

William H. Byrne
James B. Jones
Ben George Elliott
Clifford H. Shumaker

Vice-Presidents

Charles E. Crede
Frank W. Miller
Albert C. Pasini
Bryan T. McMinn

Directors

Ralph L. Goetzenberger
J. F. Downie Smith
Frank L. Bradley
Elmer O. Bergman
Robert B. Lea
Harold C. R. Carlson
George A. Hawkins
Louis Polk
Joseph Pope
Glenn B. Warren

meeting in Munich in July, 1956, 700 delegates, 51 from U. S. A. being present. For ASME participation see "International Programs of Research, Codes, and Standards."

World Power Conference held its plenary session in Vienna in June, 1956, with attendance from every industrial country in the world. The U. S. A. delegation was 150. Sixteen ASME members contributed papers to the program of 276 technical papers.

Council for International Progress in Management, the U. S. National Committee for the International Committee on Scientific Management (CIOS), sponsored 13 management study teams from abroad, 11 management seminar teams which went abroad, processed a score of management research inquiries from abroad, and continued its support of a privately financed management seminar in Finland. U. S. A. participation was organized for the First Inter-American Management Conference in Chile (November, 1956) and the Eleventh International Management Congress in Paris (June, 1957).

U. S. National Committee on Theoretical and Applied Mechanics, the U. S. A. body in the International Union of Theoretical and Applied Mechanics, provided U. S. A. participation in the Ninth International Congress on Applied Mechanics in Brussels, September 5–13, 1956, and is planning the Third U. S. National Congress on Applied Mechanics at Brown University in June, 1958.

Section M (Engineering), American Association for the Advancement of Science, provided a program for the Atlanta meeting of AAAS in December, 1955, and is working hard to make the AAAS a potent agency in synthesizing science and engineering.

The Institution of Mechanical Engineers (London) and ASME have an active program of co-operation in many areas. The publication of the Proceedings of the Combustion Conference in Cambridge (Mass.) and London in 1955, are being prepared in England for issue early in 1957. ASME contributed papers to the International Conference on Fatigue held in London, September 10–15, 1956, and is arranging a re-presentation and discussion of the papers in November during the 1956 Annual Meeting. Plans for a similar treatment of lubrication and wear problems during 1957 are well along. The IME aided ASME materially in providing secretarial service for the Fifth International Conference on Steam Properties in London in July, 1956.

The Engineering Institute of Canada co-operates with ASME through the ASME-EIC International Joint Council charged with promoting the mutual interests of both Societies. The EIC Annual Meeting in Montreal in May, 1956, was a joint meeting with ASME at which the ASME President presented one of the important addresses and the ASME Secretary was awarded Honorary Membership in EIC. During the year plans were perfected for a joint meeting in London (Ont.) on Engineering Education. Starting the first of the fiscal year an agreement became effective by which a member of ASME or EIC could become a member of the other Society without paying an initiation fee.

API-ASME Committee on Unfired Pressure Vessels since 1931 has sponsored a joint code for the petroleum industry. During the year a joint policy group came to the conclusion that the ASME Pressure Vessel Code was now in form to meet the need of petroleum industry and that the API-ASME joint effort is to be abandoned at the end of 1956.

The American Rocket Society, an affiliate of ASME, participates extensively in ASME meetings. To implement the affiliation agreement, a joint committee has been established which is working out details of closer co-operation in meetings, sections, publications, membership privileges, and methods of public announcement of the affiliation.

Co-operation in Building and Joint Funds

United Engineering Trustees, Inc., manages and maintains the Engineering Societies Building in New York and cares for the endowments for the building, the Engineering Societies Library, The Engineering Foundation, the John Fritz Medal, and the Guggenheim Medal, and serves as treasurer for the Engineers' Council for Professional Development.

Co-operation in Service

Engineering Societies Personnel Service, Inc., a co-operative effort of four national engineering societies, maintains offices in New York, Chicago, Detroit, and San Francisco to provide an efficient placement service for the engineering profession. Despite the increase in opportunities for engineers, the number of placements decreased during the year, a situation which currently is receiving active attention.

National Bureau of Engineering Registration is an agency of the National Council of State Boards of Engineering Examiners which administers a certification system designed to facilitate reciprocal registration among the States. ASME is represented on the Advisory Board. 1912 Certificates of Qualification have been issued, 117 during the year ending July 1, 1956.

Woman's Auxiliary

The Woman's Auxiliary reports 1481 members and twenty-one sections, three having been completely organized during the year at Honolulu, Inland Empire (Spokane), and Kansas City. The Calvin W. Rice Memorial Scholarship of $1500 was awarded to a student from Greece. Three Sylvia W. Farney Scholarships of $500 each went to students at Ohio State University, Texas A. and M. College, and Marquette University. Twenty-seven loans totaling $10,730 are outstanding in the loan fund.

Old Guard Committee

Members who have paid dues 35 years and are retired are dues-exempt. However, they feel a responsibility to the Society and many contribute to an Old Guard fund administered by a self-appointed committee to aid students and young engineers in a way in which Society funds could not be used. This committee is independent but it is performing a useful service and the Council takes this opportunity to express its appreciation.

Services of ASME Committees

The administrative work of the Society takes the time of many busy members whose efforts contribute much to the success of the Society. To them the Council expresses its appreciation. Brief reports of their work follow.

Finance Committee administers the Society investment

Status of the Investment Portfolios

As of September 30, 1956, the status of the three Portfolios mentioned was as follows:

	Portfolio "A" Custodian and Development Funds	Portfolio "B" General Fund and Retirement Fund	Portfolio "C" Award Funds
Cash	$ 73,350.58	$ 286,671.78	$ 5,722.91
U. S. Treasury Bills	99,435.00		
	$172,785.58	$ 286,671.78	$ 5,722.91
U. S. Treasury Bonds	$ 33,075.94	$ 244,266.26	$ 11,726.99
U. S. Savings Bonds		100,000.00	
Corporate Bonds	74,100.25	451,857.71	114,160.21
Preferred Stocks	24,419.33	96,473.51	21,268.11
Common Stocks		300,636.88	106,122.32
	$131,595.52	$1,193,234.36	$253,277.63
Grand Total	$304,381.10	$1,479,906.14	$259,000.54
Estimated Annual Income	$ 6,571.50	$ 44,135.10	$ 10,139.21
Per Cent Return on Total	2.16	2.98	3.91

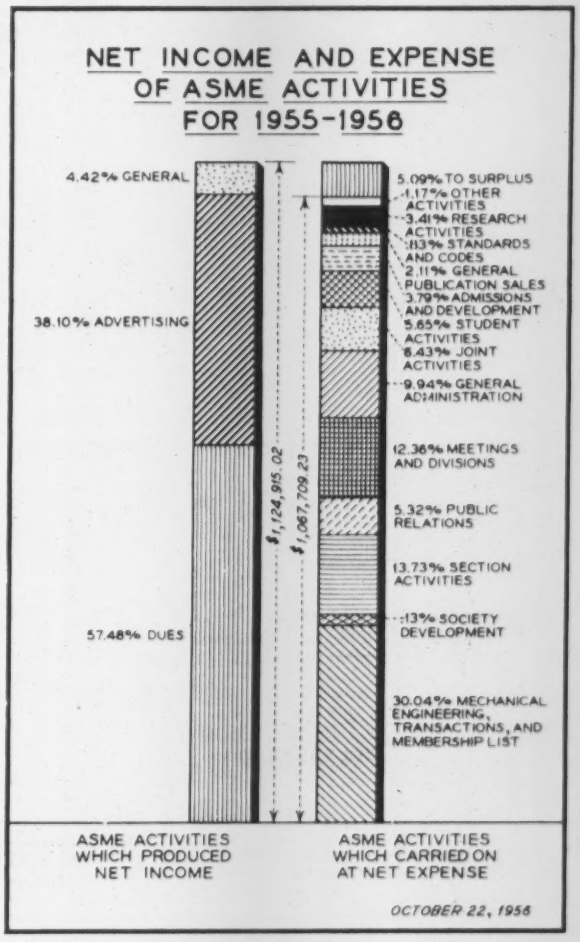
The investments of the Society have been reviewed at regular intervals during the year and the recommendations of the Investment Counsel studied and acted upon when changes in the different Portfolios were in order.

The Committee has set the general policies and goals to be attained, but the staff by its competence and loyalty has made it possible to accomplish the major purposes of the Committee.

A series of diagrams and a compilation of figures prepared by the staff are included in the following pages to aid the members in a better understanding of the finances of the Society.

Respectfully submitted,

H. J. Bauer, *Chairman*
J. O. Amstuz, *Vice Chairman*
F. B. Turck
H. E. Martin
R. B. Smith
Joseph Pope
H. R. Kessler
J. L. Kopf
E. J. Kates



ASME Finances[1]

THE income of the Society for the year ending September 30, 1956, of $2,166,354.45 was the largest in the history of the Society. A net income over expense of $57,205.79 is reported. This amount, plus initiation and transfer fees amounting to $22,020.00, makes a total addition to surplus for the year of $79,225.79.

The balance sheet of September 30, 1956, shows, on that date, that the Society owed:

(1) Current bills and federal tax withheld from employees	$ 23,399.33
(2) Obligations for printing and distributing the 1957 Mechanical Catalog and other bills which have not been submitted	53,496.60
(3) Unexpended appropriations for future services	235,775.26
(4) Future services to members who have prepaid dues	282,550.00
(5) Subscriptions paid in advance	5,000.00
	$ 600,221.19

To meet these debts the Society had:

(1) Cash in the bank	$ 276,239.31
(2) Accounts receivable	193,011.12
(3) Inventories of publications and supplies conservatively valued at	190,159.45
(4) Investments at cost	1,067,574.67
	$1,726,984.55
The difference between the value held by the Society of $1,726,984.55 and debts of $600,221.19 is the net worth of the Society on September 30, 1956	$1,126,763.36
Against this the Society has set aside a general reserve against contingencies	$ 750,000.00
This leaves a surplus of	$ 376,763.36

The Society administers a number of special funds. The condition of these is shown below:

(1) Custodian and Development Funds		$ 304,381.10
Against which it had:		
(a) Cash	$ 73,350.58	
(b) Securities (at cost)	231,030.52	
	$304,381.10	
(2) Employees' Retirement Fund of		$ 136,092.16
Against which it had:		
(a) Cash	$ 10,432.47	
(b) Securities (at cost)	125,659.69	
	$136,092.16	

[1] The certified report of the auditors, Price Waterhouse & Co., is on file in the Society's office and available for inspection by ASME members.

ASME Finance Committee

Report for 1955–1956

THE Finance Committee has completed the Annual Budgets of the Society as required and has supervised the investment and expenditure of the Society's funds during the year. The Committee had the guidance of Scudder, Stevens & Clark's professional investment counsel in the investment of funds, and the loyal assistance and cooperation of the staff in supervising the collection and expenditure of the Society's Funds.

The gross income for the fiscal period ending September 30, 1956, was $2,166,354.45, the highest in the history of the Society. The expenses for the same period totaled $2,109,148.66, leaving a net income of $57,205.79.

The annual income from the Society's Funds under the control of the Finance Committee has increased steadily as shown by the following tabulation:

Annual Income of Society Funds

	Total Society Funds Cost	Income
1951–1952	$1,299,457.85	$31,191.06
1952–1953	1,010,865.50	38,540.56
1953–1954	1,481,419.90	41,241.77
1954–1955	1,504,841.93	48,429.01
1955–1956	1,677,542.51	63,390.96

Appreciation in values and the increase in income from 1951 to 1956 were due to the investment of money in higher income securities, the retention of minimum cash working balances, and the investment of temporary funds in Government notes wherever possible. All securities are carried on the books at cost.

During the past five years the Finance Committee with the approval of the Executive Committee has made changes in the investment policy to be followed with respect to the Funds entrusted to its supervision, and is presently operating under the following general policy which is designed to provide for: (1) Safety and marketability of principal, (2) maintenance of purchasing power, (3) reasonable yield on invested funds, and (4) maintenance of the minimum cash working funds.

The Funds of the Society are divided into three major Portfolios:

Portfolio "A"—Custodian and Development Funds. The Custodian Fund represents money contributed to the Society by industry for special research projects of interest to contributing groups. Also included are Division Funds accumulated for special Division activities.

The Development Fund represents money contributed to the Society by individuals and industry for self-liquidating projects of interest to the engineering profession.

Portfolio "B"—General Fund and Retirement Fund. The General Fund includes the contingency operating reserve of the Society, the employment reserve, the working funds, and the surplus funds of the Society.

The Retirement Fund provides reserves for retirement benefits for employees of the staff.

Portfolio "C"—Award Funds. The Award Funds consist of donations to the Society by individuals and others to provide awards to engineers and students.

Portfolio "A" shall be invested in high-grade bonds and preferred stocks to provide maximum safety of principal.

Portfolio "B" shall be invested in high-grade bonds and preferreds, equity-risk bonds and preferreds, and common stocks within the following limits:

Proportion of Investment Funds in Various Types of Securities

	With maximum % in common stock	With minimum % in common stock	With average % in common stock
Common Stocks	40%	20%	30%
Equity-Risk Bonds & Preferred Stocks	15%	0	10%
High-Grade Bonds & Preferreds	45%	80%	60%

Portfolio "C" shall be 98 per cent invested in high-grade bonds and preferreds, equity-risk bonds and preferreds, and common stocks, the relative proportion of each type of investment to be modified from time to time by the Finance Committee in accordance with the following limits:

Common Stocks	50% Maximum
Equity-Risk Bonds & Preferreds	10% Maximum
High-Grade Bonds & Preferreds	40% Minimum

As the return on bond investments and economic conditions indicate, consideration will be given to changing the percentages of the types of securities in Portfolios "B" and "C."

The cash working capital required for normal needs shall be invested so far as practicable in income-earning U. S. Treasury Bills.

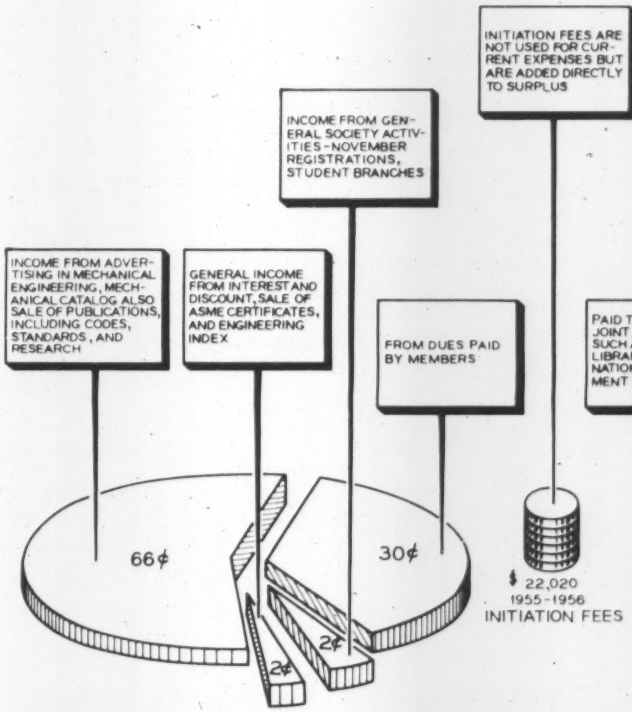
Investments shall be made with the advice of a professional investment counsel and the approval of the Finance Committee.

For accounting purposes, specific securities in Portfolio "B" are to be allocated to the General Fund and to the Retirement Fund to provide approximately the same proportions of types of securities in each of the two Funds. Investment income of the General Fund is to be allocated either to the general income of the Society or to surplus by the Council on recommendation of the Finance Committee; said allocation to be made prior to the closing of the books each year.

Fund participants in Portfolios "A" and "C" shall share, at the end of each fiscal year, in the earnings and capital gains or losses of the respective Portfolio in the ratio of the market value of each Fund to the total market value of the Portfolio, provided the market value of the fund exceeds $500. Market values and ratios of each Fund in Portfolios "A" and "C" shall be determined at the start of each fiscal year and modified in the preceding manner each time an additional Fund is added to either Portfolio.

Table 5 Total Income and Expense for Major Groups of Society Activities

	Expense	Income	Net	Expense per member	Income per member	Net expense per member
Dues	....	$ 646,549.81	+$646,549.81	....	$15.53	....
General Income (interest, discount, emblem sales, Engineering Index, Inc.)	....	49,783.21	+ 49,783.21	....	1.20	....
Publications, Standards, Codes, and Research	$1,405,239.07	$1,430,266.58	+ 25,027.51	$33.75	34.35	+$ 0.60
General Society Activities (meetings, sections, student branches, missions, etc.)	519,671.94	39,754.85	— 479,917.09	12.48	0.95	11.53
General Society Administration (Council, auditors, counsel, retirement fund)	111,860.70	....	— 111,860.70	2.69	....	2.69
Joint Activities (Library, ECPD, EJC, ASEE, etc.)	72,376.95	....	— 72,376.95	1.74	....	1.74
Addition to surplus from operating income	57,205.79	....	....	1.37	....	....
Total	$2,166,354.45	$2,166,354.45	....	$52.03	$52.03	$15.36
Addition to surplus from initiation fees		22,020.00				
Total addition to surplus		79,225.79				


INCOME FROM ADVERTISING IN MECHANICAL ENGINEERING, MECHANICAL CATALOG ALSO SALE OF PUBLICATIONS, INCLUDING CODES, STANDARDS, AND RESEARCH
GENERAL INCOME FROM INTEREST AND DISCOUNT, SALE OF ASME CERTIFICATES, AND ENGINEERING INDEX
INCOME FROM GENERAL SOCIETY ACTIVITIES - NOVEMBER REGISTRATIONS, STUDENT BRANCHES
FROM DUES PAID BY MEMBERS
INITIATION FEES ARE NOT USED FOR CURRENT EXPENSES BUT ARE ADDED DIRECTLY TO SURPLUS
66¢
30¢
2¢
2¢
$ 22,020
1955-1956
INITIATION FEES

WHERE ASME INCOME DOLLAR COMES FROM

TOTAL INCOME - 1955-1956 - $2,166,354.45

PAID FOR GENERAL SOCIETY ADMINISTRATION WHICH INCLUDES COUNCIL MEETINGS PROFESSIONAL SERVICE SUCH AS COUNSEL AND AUDITORS, NOMINATING COMMITTEE, RETIREMENT FUND, ETC.
PAID FOR GENERAL SOCIETY ACTIVITIES INCLUDING MEETINGS, SECTIONS, PROFESSIONAL DIVISIONS, PUBLICITY, STUDENT BRANCHES, AWARDS, ETC.
PAID FOR PAPER, PRESSWORK, ETC FOR MECHANICAL ENGINEERING, TRANSACTIONS, MEMBERSHIP LIST, PUBLICATION SALES, CODES, STANDARDS, AND RESEARCH
PAID TO SUPPORT JOINT ACTIVITIES SUCH AS ECPD, EJC, LIBRARY, ESPS, NATIONAL MANAGEMENT COUNCIL, ETC.
ADDITION TO SURPLUS
65¢
3¢
3¢
24¢
5¢

HOW THE ASME INCOME DOLLAR WAS SPENT

TOTAL EXPENSES 1955-1956 - $2,109,148.66 *

*ADDITION TO SURPLUS $ 57,205.79

(3) Award Funds amounting to		$ 262,584.07
Against which the Society had the following assets:		
(a) Cash	$ 5,722.91	
(b) Securities (at cost)	253,277.63	
(c) Notes receivable	3,583.53	
	$262,584.07	

The Engineering Building is owned jointly by the major societies through United Engineering Trustees, Inc. ASME interest, and other long-term assets, are treated as a fully reserved fund:

(1) Property Fund of		$ 614,028.13
With these assets to support it:		
(a) ASME quarter interest in real estate and certain other assets of the United Engineering Trustees, Inc.	$498,448.48	
(b) Office furniture and fixtures (depreciated value)	115,578.65	
(c) Engineering Index, Inc., Title and good will	1.00	
	$614,028.13	

Table 4 shows Society operations which produce net income and those which result in net expense. Table 5 shows income and expense by major groupings of Society activities.

Table 4 Analysis of Income and Expense

(In this analysis, each expense item includes an allocated share of the indirect expense)

A	*Income items against which no charges are made*		
1	Membership Dues		$ 646,549.81
2	Interest and Discounts		43,721.11
3	Miscellaneous Sales		3,562.10
4	Engineering Index, Inc.		2,500.00
			$ 696,333.02
B	*Activities which produce a net income*		
1	Advertising in MECHANICAL ENGINEERING and Mechanical Catalog	$1,004,858.45	
	Less: Expenses for producing advertising pages and selling the advertising	576,276.45	428,582.00
			$1,124,915.02
C	*Activities with some income which result in a net expense*		
1	General Publication Sales Income	$ 95,974.80	
	Less: Cost of producing publications sold, mailing cost, and selling cost	119,730.31	$ 23,755.51
2	Standards and Codes Income (from sales of publications)	$ 275,089.39	
	Less: Cost of producing codes and standards sold, mailing cost, selling cost, and servicing of committees	284,447.07	$ 9,357.68
3	Research Income (from sales of research reports)	$ 2,293.17	
	Less: Cost of producing research reports sold, mailing cost, selling cost, and servicing research committees	40,603.27	$ 38,310.10
4	Transactions and *Journal of Applied Mechanics* Income (from publication sales)	$ 52,050.77	
	Less: Cost of producing Transactions and *Journal of Applied Mechanics* sold, mailing cost, selling cost, plus free copies for depositories	170,957.24	$ 118,906.47
5	Student Dues	$ 34,701.00	
	Less: Appropriations to Student Branches, cost of 12 student-branch conferences, cost of copies of MECHANICAL ENGINEERING mailed to students, and cost of office services	98,301.97	$ 63,600.97
6	Meetings Income (from registration fees)	$ 5,053.85	
	Less: Cost of meetings and cost of office service	87,397.94	$ 82,344.09
D	*Activities expense against which no income is credited*		
1	Public Relations		$ 59,840.59
2	MECHANICAL ENGINEERING text pages (costs of printing and editorial)		207,199.93
3	Membership List (cost of compiling, printing, and editorial)		11,807.34
4	Sections (appropriations to Sections, costs of Regional Administrative Committees, cost of Regional Delegates Conference, travel in Regions, cost of office service, and cost of national lectureships)		154,383.27
5	Professional Divisions (appropriations to Professional Divisions and office costs)		56,670.73
6	Admissions and Development (office costs for Admissions Committee and Membership Development Committee)		42,613.62
7	Awards (cost of medals, prizes, and certificates, and office service)		9,411.10
8	Joint Activities (appropriation for Library, ECPD, EJC, etc.)		72,376.95
9	General Administrative (expenses of the Council, Retirement Fund, and office service)		111,860.70
10	Society's 75th Anniversary		2,298.00
11	Organization Charts		1,012.60
12	Civic Affairs Committee		500.00
13	Society Development		1,459.58
			$1,067,709.23
	Net Income		$ 57,205.79

Brothers, predecessor to the firm of Gibbs and Cox, supervised reconditioning of the SS *Leviathan* and other large ships. Beginning in 1933, Mr. Gibbs undertook the design and engineering of destroyers for the U. S. Navy and was instrumental in bringing about the development of high-pressure, high-temperature, steam-turbine machinery, with exceptional increases in efficiency. His advanced designs were later adapted for use in the entire U. S. surface fleet.

With the advent of World War II, the firm of Gibbs and Cox began what was to be a major role in building a wartime navy. A final tally showed that the firm had directed the preparation of working plans for more than 60 per cent of all major ships (except battleships and submarines) constructed in this country during the war. More than 5000 ships were built to Gibbs and Cox plans during this period.

Mr. Gibbs is a member of leading professional and learned societies and holds honorary doctoral degrees from Stevens Institute of Technology, Harvard University, New York University, and Bowdoin College. He is the recipient of many awards including the American Design Award, the David W. Taylor Gold Medal (Society of Naval Architects and Marine Engineers), Presidential Award of Certificate of Merit, the Holland Society Distinguished Achievement Gold Medal, National Defense Transportation Award, The Franklin Institute Gold Medal, and the Elmer A. Sperry Award.

Solomon Cady Hollister

Solomon Cady Hollister, educator, engineer, and civic leader, began his career in the field of education in 1916, when he taught mechanics at the University of Illinois soon after being graduated from the University of Wisconsin.

S. C. Hollister

During World War I he became chief designing engineer for the concrete ships of the Emergency Fleet Corporation, and served again as advisory engineer to the Maritime Commission's concrete ship program in World War II.

Following World War I he practiced as a consulting engineer in Philadelphia, Pa., for ten years but returned to the field of education in 1930, becoming professor of structural engineering and assistant director of the Materials Laboratory at Purdue University. Four years later, he accepted the post of director of Civil Engineering at Cornell University where, in 1937, he became dean of the College of Engineering.

In 1949 Dean Hollister called attention of engineering educators to the fact that the predicted surplus supply of engineers would not materialize. He continued to focus attention on the shortage of engineers as it developed and to call for prompt action to meet it. He has been an advisor to the director of Selective Service and a consultant to the Office of Defense Mobilization and to the Engineering Manpower Commission of Engineers Joint Council. He has served on a number of governmental task forces and other advisory bodies and, in 1953, was named a member of the secondary Hoover Commission.

In addition to his activity in the Applied Mechanics Division of ASME, Dean Hollister has served as officer or committee member of many other professional groups. During his term as chairman of the Education Committee of the Engineers Council for Professional Development, great strides were made in providing and clarifying policies to guide the profession. Outstanding among these contributions were the Committee's reports, "Differentiating Characteristics of an Engineering Curriculum" and "Adequacy and Standards of Engineering Education," both of which are landmarks to those concerned with elevating the quality of engineering education.

Medals and Awards

ASME Medal

The ASME Medal, established in 1920, is awarded for "distinguished service in engineering and science." The Society established this award so that it might give recognition not only to outstanding engineering achievement, but also to achievement in science which is capable of application in engineering fields. Through the years the world's engineers and scientists have come to regard the ASME Medal as a reward of merit which ranks among the highest in the scientific field.

Perhaps this is because of the broad interpretation of engineering and science which has been used by the Society in bestowing this medal. To qualify for the ASME Medal a person does not have to be a member of ASME or even an engineer. He may be a scientist, industrialist, public official, or anyone who has rendered distinguished service in engineering and science. The award has been made in areas of:

1 Scientific, experimental, and industrial research and development, and the organization and administration of such activities.

2 The application of the results of research to the design and/or operation of equipment, plants, organizations, methods, and processes.

3 Technical and industrial leadership in the organization and administration of research, engineering, and industrial operations.

The roll of ASME Medallists contains the names of eminent engineers and scientists who have rendered distinguished service in their chosen fields of endeavor, such as management, manufacturing, physics, power generation, engineering design, machine tools, lubrication, air conditioning, optics, and marine construction.

The first ASME Medal was awarded to Hjalmar G. Carlson in recognition of the services he rendered the government through his invention and production of drawn steel booster casings.

Harry F. Vickers

Harry F. Vickers, who has been president of Sperry Rand Corporation since its formation in 1955 with the consolidation of Sperry Corporation and Remington Rand, Inc., has a long record of engineering achievement and industrial administration.

His work in naval ordnance during the 1930's led to completely new systems of hydraulically-operated ammunition handling and naval-gun operation. For his contributions to World War II naval efficiency he was commended by Admiral Harold Stark, former chief of the U. S. Navy Bureau of Ordnance. He also contributed extensively to hydraulic-control systems used on B-17, B-24, and B-29 bombers.

Mr. Vickers started his own business to build hydraulic equipment in Los Angeles, Calif., in 1921, after interrupting his education to serve with the U. S. Army Signal Corps in France, during

ASME Honors Engineers

Biographies of Recipients of Honorary Membership and Awards at the 1956 ASME Annual Meeting

THE bestowal of honorary memberships, medals, and awards is a colorful feature of the ASME Annual Banquet where the attendance this year exceeded 1400 persons. A description of the banquet and a list of the recipients of honorary-membership certificates, prizes, and awards will be found on other pages of this issue. In the following pages brief biographies are presented so that members of the Society may know what manner of men they have honored.

Honorary Membership in ASME, which was the Society's initial form of award, has throughout the years remained the Society's highest honor. It is conferred upon distinguished persons in engineering, science, industry, research, public service, and allied pursuits.

Basis for awarding honorary membership is "effective and faithful service rendered to the Society, to the engineering profession, or to the public." The character and scope of the service rendered are the predominant criteria rather than strictly engineering or scientific attainments. Hence the honor is distributed widely in all walks of life enhanced by the skill, leadership, and experience of engineers and those with whom they work and associate.

The first honorary member, Horatio Allen, was elected in 1880, the year of the Society's founding. Three of the founders of the Society—Alexander Lyman Holley, John Edson Sweet, and Henry R. Worthington—were elected Honorary Members in Perpetuity.

Honorary membership in ASME gains added prestige because engineers throughout the world are eligible. Of the 177 honorary members chosen previously, over one-third have been citizens of foreign countries. These include Belgium, Canada, China, Denmark, France, Germany, Great Britain, Italy, Japan, Sweden, Switzerland, and Uruguay.

Normally, up to five honorary members may be named each year. Nominations are made through the ASME Board of Honors and elections are approved by unanimous vote of the Council.

Honorary Members

Charles W. E. Clarke

CHARLES W. E. CLARKE, an engineer whose achievements during a lifetime devoted to the field of power are outstanding, even when compared with the many other accomplishments which made the past half century a period of unprecedented growth in the field, has fully earned the high regard in which he is held by his fellows.

At the age of 20 Mr. Clarke was employed by the firm of Sargent and Lundy of Chicago, Ill., as a draftsman, to work on what were then considered enormous turbogenerators, each of which had a capacity of 5000 kws.

From his modest contributions to this early project, Mr. Clarke moved successively to the post of chief draftsman and later assistant to the chief engineer of Sargent and Lundy. Then, in 1907, at the age of 25, he was appointed steam engineer of the New York Central and Hudson River Railroad in charge of power stations and other related activities. Three years later, he became mechanical engineer of Stone & Webster Engineering Corporation.

Finally, in 1918, Mr. Clarke joined a new corporation which eventually became United Engineers and Constructors, Inc. With this company he became, successively, consulting engineer, vice-president, and director.

In addition to his industrial work, Mr. Clarke has been active in the Institution of Mechanical Engineers of Great Britain, of which he is a member, found time during World War I to act as a member of a team which provided power to the American Expeditionary Force in France, served during World War II as a member of an EJC group dealing with problems of reconstruction of German and Japanese industrial installations, and has attended most World Power Conferences as a delegate.

Since joining ASME in 1907, Mr. Clark has been active in many of the Society's activities, becoming a Fellow in 1938. He is also a member of the Iron and Steel Engineers Association and of Edison Electric Institute and its Prime Movers Committee, where he served as chairman of the Gas Turbine Subcommittee for many years.

William Francis Gibbs

WILLIAM FRANCIS GIBBS, during his 40 years of professional life, has built a career which reached its crowning achievement in the design of the superliner SS United States.

A native of Philadelphia, Pa., Mr. Gibbs received his early education there and attended Harvard College from 1906 to 1910. In 1913 he received both the Bachelor of Law and the Master of Arts degrees from Columbia University.

During World War I the firm of Gibbs

C. W. E. Clarke

W. F. Gibbs

J. K. Louden

O. W. Boston

W. W. Gilbert

industrial administration and engineering throughout his professional career. Since graduation from Ohio State University in 1928 with the BS degree in Business Administration, he has devoted his attention to a number of industrial operations. He is a registered professional engineer in Ohio and Pennsylvania.

In addition to his book, "Wage Incentives," published in 1944, Mr. Louden is coauthor of "Job Evaluation," and the paper "Work Measurement," which was presented before the ninth International Management Conference at Brussels, Belgium, in 1951, and later published in *Organization Scientifique*, technical publication of the Belgian Committee on Industrial Management. He has also written a number of papers in the field of management published in leading periodicals.

An additional contribution to understanding of management problems was made by Mr. Louden between 1939 and 1952 when he delivered a series of lectures at the State University of Iowa's Summer Management course and was speaker on the programs of management and technical groups and college forums.

Mr. Louden became an honorary life member of the Society for the Advancement of Management in 1946 and holds the Gilbreth Medal awarded by that group. He was elevated to the grade of Fellow of the ASME in 1955. In addition, he is a member of the American Management Association Board of Directors, as well as a member of the Industrial Engineering Advisory Committee of the College of Engineering of the University of Michigan.

Blackall Machine Tool and Gage Award

The Blackall Machine Tool and Gage Award is named for Frederick S. Blackall, jr., president and treasurer of The Taft-Peirce Manufacturing Company, who served successively as president of The National Machine Tool Builders' Association in 1952, and as president of The American Society of Mechanical Engineers in 1953. It is awarded annually to the author or authors of such paper or papers deemed the best of those submitted to the Society on a subject clearly concerned with or related to the design or application of machine tools, gages, or dimensional measuring instruments. There is no limitation as to age, nationality, or society membership.

The first award of the Blackall Machine Tool and Gage Award was made in 1955 at the ASME Diamond Jubilee Annual Meeting in Chicago, Ill., to Carl J. Oxford, Jr. and John A. Cook.

O. W. Boston and W. W. Gilbert

The Blackall Machine Tool and Gage Award was awarded jointly in 1956 to Orlan W. Boston and William W. Gilbert.

Orlan W. Boston, for 40 years a member of the faculty of the College of Engineering, University of Michigan, is now professor emeritus of mechanical and production engineering. He was graduated from the University of Michigan in 1914 with a BME degree, received a master's degree in 1917 and the ME in 1926 from the same university. He was instructor in engineering mechanics and machine design at the University of Michigan from 1914 to 1917.

After serving in the U. S. Navy and in private industry, Mr. Boston was recalled to the University of Michigan in 1921 to assist in the planning of the East Engineering Building and to develop the department of metal processing (later production engineering) with courses covering inspection, design, machinability, machine tools, and processing.

His researches, private and sponsored, have resulted in about two hundred and fifty papers and several books on metal processing and production engineering.

William W. Gilbert is manager, machinability, in the manufacturing services department of the General Electric Company. The Carboloy Machinability Computer was developed under his supervision.

Prior to 1944, Dr. Gilbert was professor of production engineering at the University of Michigan, where he taught production-engineering courses and specialized in research work in metal cutting. He has published numerous papers dealing with tool life, power requirements, and surface finish in metal cutting.

Dr. Gilbert received his BS degree in mechanical engineering from the University of Colorado in 1931; his MS degree from the University of Michigan in 1932; and his DS degree at the University of Michigan in 1935.

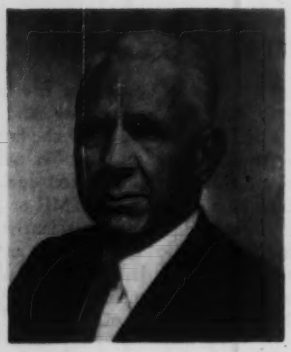
Arthur L. Williston Award

The Arthur L. Williston Award, established in 1954 by Arthur L. Williston, Mem. ASME, is awarded for the best brief or thesis by an undergraduate student or a junior engineer on the prescribed subject.

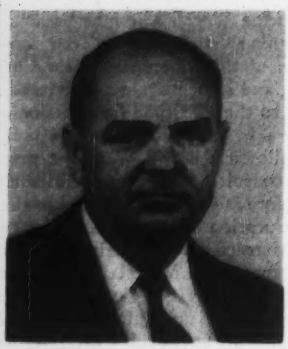
To be considered for the award, papers must deal with changes in, or additions to, engineering college curriculums designed to encourage a spirit of civic responsibility and interest in constructive social or public activities.

Eligible for the award are undergraduates in their junior or senior year of a course in mechanical engineering or junior engineers who have received their degrees within two years prior to the date of the award.

The purpose of the award is to stimulate interest in public affairs on the part of engineers and to encourage civic activities which will benefit American civilization.



H. F. Vickers



P. W. Pratt

World War I, where he was in charge of construction of what was then a very powerful radio transmitter which maintained daily contact with the United States.

His concern, Vickers, Inc., moved to Detroit, Mich., in 1930, where it became the largest of its kind in the nation and eventually merged with the Sperry corporation of which Mr. Vickers became successively senior vice-president and president.

Mr. Vickers is a member of The American Society of Mechanical Engineers, American Ordnance Association, Engineering Society of Detroit, Institute of the Aeronautical Sciences, National Aeronautic Association, National Security Sciences, National Aeronautic Association, National Security Industrial Association, Society of Automotive Engineers, and the Society of Naval Architects and Marine Engineers. He holds a private pilot's license with multi-engine rating.

Mr. Vickers was awarded the DS degree by the University of Southern California. He holds 95 patents on hydraulic devices and other inventions.

ASME George Westinghouse Gold Medal

The ASME George Westinghouse Gold Medal, which was first presented at the Society's 1953 annual meeting, is bestowed annually, if warranted, for "eminent achievement or distinguished service in the power field of mechanical engineering."

It was instituted at the 1952 annual meeting at the suggestion of the Westinghouse Educational Foundation that such an award be established "to perpetuate the value of the rich contributions to power development made by George Westinghouse, honorary member and twenty-ninth President of the Society."

At an early stage in the development of electric power, Westinghouse realized the potential value of utilizing alternating instead of direct current and was instrumental in developing the necessary apparatus, including the transformer, the induction motor, and the steam turbine.

Based upon a broad interpretation of the term "power," the award recognizes contributions of utilization, application, design development, research, and the organization and administration of such activities in the power field. Candidates are not restricted by age or profession, nor is membership in any engineering society or organization a factor.

The first recipient was Alexander G. Christie, emeritus professor of mechanical engineering at The Johns Hopkins University.

The Westinghouse Educational Foundation, which furnished a gift for endowment of the award in 1953, engages science and education.

Perry Walter Pratt

The 1956 ASME George Westinghouse Gold Medal was awarded to Perry Walter Pratt for his eminent achievements in the field of aircraft propulsion.

Born in Lompoc, Calif., he received his early education in Corvallis, Ore. and attended Oregon State College, where he received the BS degree in Mechanical Engineering in 1936.

After being graduated, he moved to the East to continue his studies at Yale University and New York University where he also served as instructor. He joined Pratt & Whitney Aircraft in 1937 as a test engineer and advanced through the positions of assistant project engineer, project engineer of single-row engines and the R-2800 Double Wasp Engine, head of the Technical and Research Section of the gas-turbine department, and assistant chief engineer. He reached his present position of chief engineer in 1952.

During the period of Mr. Pratt's career, the aircraft engine advanced from a comparatively inefficient instrument to the compact, light, tremendously powerful device which makes possible today's marvels of supersonic speeds. Much of this progress is due to his leadership and vision.

Mr. Pratt is the holder of patents on engine-induction apparatus and ignition control. He has served as chairman of the Subcommittee on Engine Performance and Operation of the National Advisory Committee for Aeronautics. He is a member of The American Society of Mechanical Engineers and The Society of Automotive Engineers, and is a Fellow of the Institute of Aeronautical Sciences.

During his career Mr. Pratt has become a member of four honorary professional fraternities: Tau Beta Pi, Sigma Tau, Pi Mu Epsilon, and Pi Tau Sigma.

Worcester Reed Warner Medal

The Worcester Reed Warner Medal was established in 1930 by bequest of Worcester Reed Warner, charter member and sixteenth President of the Society. It is awarded for an outstanding contribution to the permanent literature of engineering. In order to qualify for consideration, such literature must be not less than five years old and shall be recognized as a noteworthy contribution to the profession.

Topics must deal with items such as engineering, scientific and industrial research associated with mechanical engineering, design and operation of mechanical and associated equipment, industrial engineering or management, or closely related subjects.

The award consists of gold medal and certificate. Recipients need not be members of The American Society of Mechanical Engineers.

The Worcester Reed Warner Medal was first conferred in 1933 when the recipient was the late Dexter S. Kimball, ASME President in 1922, author of "Principles of Industrial Organization."

James Keith Louden

The 1956 Worcester Reed Warner Medal was conferred upon James Keith Louden, Fellow ASME, in recognition of the unique and valuable contribution made by his book, "Wage Incentives," and his other publications.

Mr. Louden, director, vice-president, and general manager of the York Corporation, has been active in the fields of

J. A. Clark

mechanical-engineering course of a recognized American college or university, shall be eligible for recognition.

Nominations may be made by any member or group of members of Pi Tau Sigma, any Section of ASME, the head of the mechanical-engineering department of any American college or university offering the regular four-year course or its equivalent in mechanical engineering, and other qualified individuals. From the nominations submitted, Pi Tau Sigma recommends to the ASME Board on Honors ten candidates for the award. The Board then selects the recipient and, with Council approval, the award is presented usually at the ASME Annual Meeting.

The Pi Tau Sigma Gold Medal Award was first conferred in 1938 on Wilfred E. Johnson.

John A. Clark

The Pi Tau Sigma Gold Medal for 1956 was awarded to JOHN A. CLARK, assistant professor of mechanical engineering at the Massachusetts Institute of Technology, Cambridge, Mass. Dr. Clark was born in Ann Arbor, Mich., in 1923 and attended school in Royal Oak, Mich., where he was graduated from high school in 1941. He began college in 1941 on a scholarship at the Lawrence Institute of Technology, completing one and one-half years before being called into active duty with the U. S. Army Air Force. Dr. Clark served as a pilot with the Eighth U. S. Air Force in England, flying 32 combat missions in B-17's with the 100th Bombardment Group.

In the fall of 1945 he entered the University of Michigan from which he was graduated in February, 1948, with the BS degree in mechanical engineering. Graduate studies followed at M.I.T., where he received the degrees of MS in 1949 and DS in 1953, both in mechanical engineering.

Dr. Clark has been on the M.I.T. research staff since 1949 and a member of the faculty since 1952. In February, 1957, Dr. Clark will assume new duties at the University of Michigan where he was recently appointed professor of mechanical engineering.

Dr. Clark is engineering consultant to a number of large industrial engineers. His principal current activity is teaching and research in the fields of heat transfer and thermodynamics. He has written papers on the subjects of temperature measurement and instrumentation, thermal properties of materials, boiling heat transfer, nucleation, and heat-exchanger dynamics.

Dr. Clark is an honorary member of Pi Tau Sigma and a member of Sigma Xi, Tau Beta Pi, and Phi Kappa Phi. He is an Associate Member of ASME.

Prime Movers Committee Award

This annual award, established in 1954 from a fund donated by the Prime Movers Committee of the Edison Electric Institute, is conferred in recognition of outstanding contributions to the literature of thermal electric-station practice or equipment.

The men listed below were recipients of the 1956 Prime Movers Committee Award for their paper "Description of the Pressurized Water Reaction (PWR) Plant at Shippingport, Pa.," presented at the International Conference on Peaceful Uses of Atomic Energy, August, 1955, Geneva, Switzerland.

(A) R. B. Donworth, (B) W. J. Lyman, (C) I. H. Mandil, (D) N. J. Palladino, (E) Milton Shaw, and (F) J. W. Simpson

ROBERT B. DONWORTH, Mem. ASME, is a vice-president of Duquesne Light Company of Pittsburgh, Pa. He is currently in charge of engineering and construction and has held the post of manager of the company's Atomic Power Development Department.

WALTER J. LYMAN, vice-president, Duquesne Light Company, in charge of operations, has the responsibility for developing the operating organization for the Shippingport Plant, selecting and training the personnel, and operating the plant after its completion.

L. HARRY MANDIL is director of the Reactor Engineering Division of the U. S. Navy Bureau of Ships. He is also chief of the Reactor Engineering Section, Naval Reactors Branch, Reactor Development Division of the U. S. Atomic Energy Commission.

NUNZIO J. PALLADINO, Mem. ASME, is manager of the PWR Reactor Design Subdivision of Westinghouse Electric Corporation. He was one of the original participants in the design of the first submarine reactor and its land-based prototype.

MILTON SHAW is director of the Advanced Design Division, Nuclear Propulsion Divisions, Bureau of Ships. He is also chief of the Advanced Design Section, Naval Reactors Branch, Reactor Development Division, of the U. S. Atomic Energy Commission.

JOHN WISTAR SIMPSON, Mem. ASME, is manager of the Bettis Atomic Power Division of the Westinghouse Electric Corporation, Pittsburgh, Pa. He has received the Certificate of Commendation from the U. S. Navy and the Westinghouse Order of Merit.

Charles T. Main Award

Marion J. Balcerzak

The CHARLES T. MAIN Award was established in 1919 from a fund created by Charles T. Main, past-president of the Society, to be awarded for the best paper by a student member concerning the influence of engineering on public life. The winner in 1956 was Marion J. Balcerzak for his paper, "The Modern High School Program as a Preparation for Engineering Education."

MARION J. BALCERZAK was born in Baltimore, Md., in 1933 and attended Maryland schools. He enrolled at the University of Detroit where he was graduated in 1955, magna cum laude, with a BME degree.

In August, 1956, Mr. Balcerzak was commissioned a Second Lieutenant in the United States Army Ordnance Corps. Not yet on active duty, he is currently a graduate assistant in mechanical engineering at Northwestern University, Evanston, Ill., working toward the MS degree in mechanical engineering.

A certificate, a bronze medal, and a cash prize constitute the award.

The Arthur L. Williston Award is to be conferred for the first time in 1956 at the ASME Annual Meeting in New York, N. Y.

John A. Welsh

Recipient of the 1956 Arthur L. Williston Award was JOHN A. WELSH, for his paper, "Building Character in Undergraduates." Mr. Welsh was born in Philadelphia, Pa., in 1925 and was graduated from Bensalem High School in Cornwells Heights, Pa., in 1943. Following graduation he enlisted as a cadet

J. A. Welsh

in the U. S. Air Force pilot training program and served in the Far East, flying in Korea and Japan.

After receiving his military discharge in Tokyo, he accepted employment with the U. S. Government as a civil aeronautics inspector in Korea. Leaving Korea in March, 1948, he returned home via China, India, Egypt, and Great Britain. Arriving in the United States in June, he entered Drexel Institute of Technology as a freshman in mechanical engineering. While enrolled, under a cooperative plan of education, he worked for the Black & Decker Manufacturing Company in Baltimore, Md.

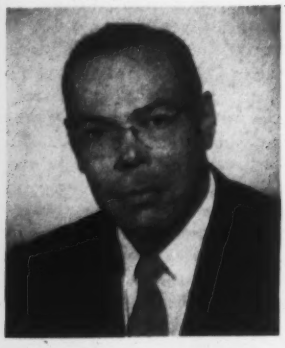
Interruping his education in 1951, Mr. Welsh accepted a position with the U. S. Army Corps of Engineers to work on construction of airbases in French Morocco.

Returning again to the United States in 1953, Mr. Welsh entered Massachusetts Institute of Technology where he was awarded the BS degree in 1955 and the MS degree in 1956, both in mechanical engineering. He now holds an appointment as an instructor at M.I.T. where he is continuing his graduate study.

Richards Memorial Award

The Richards Memorial Award, established in 1944, was named in honor of Charles Russ Richards, founder of Pi Tau Sigma, honorary mechanical engineering fraternity.

It is given annually for outstanding achievement to a mechanical engineer who has been graduated for not more than 25, nor less than 20 years, from the regular mechanical-engineering curriculum of a recognized college or university. His achievement may be all or in part in any field, including industrial, educational, political, research, civic, or artistic.



E. M. Barber

Nominations may be made by any member or group of members of Pi Tau Sigma, any Section of ASME, the head of the mechanical-engineering department of any American college or university offering the regular four-year course or its equivalent in mechanical engineering, and other qualified individuals. From the nominations submitted, Pi Tau Sigma recommends to the ASME Board of Honors ten candidates for this award. The Board then selects the recipient and, with Council approval, the award is usually conferred at the ASME Annual Meeting.

The Richards Memorial Award was first conferred on Jacob P. den Hartog in 1947.

Everett M. Barber

EVERETT M. BARBER, a native of Oil City, Pa., received the BS degree in mechanical engineering from The Pennsylvania State University in 1931. From 1931 through 1933 Mr. Barber held the Elliott Fellowship at Penn State where he did research on lubrication and continued his studies. He received the MS degree in mechanical engineering from Penn State in 1933. Mr. Barber was employed at The Texas Company's Research Laboratories at Beacon, N. Y., in 1933 and he has been there continuously except for one year, 1936–1937, spent as a Gordon McKay fellow at Harvard Graduate School of Engineering. He has served as head of several large departments and was responsible for the organization and development of two research departments at The Texas Company's laboratories.

For almost 20 years he has been a member of one or more committees of the Co-ordinating Research Council. He served on an NACA subcommittee on Aircraft Fire Prevention and on the Advisory Board of API Project 42 on the Synthesis and Properties of High Molecular Weight Hydrocarbons. Currently, he is a member of the ASTE Research Fund's Committee on Metal Cutting, and is serving a second five-year term as a member of The Engineering Foundation and a second term as chairman of the board.

In ASME, Mr. Barber is a member of the Research Committee on Lubrication, 1957 Chairman of the Research Executive and Research Planning Committees, and a member, for 1957, of the Board on Technology.

In 1932 Mr. Barber received an award from ASRE for a paper on "Bearing Lubrication Analysis" and in 1947 he shared, with coauthors, a Lewis Edward Levy Medal awarded by The Franklin Institute for a paper on "The Elimination of Combustion Knock." Mr. Barber is a member of the Penn State chapters of Sigma Xi, Pi Tau Sigma, and Pi Mu Epsilon. He is a licensed Professional Engineer in the state of New York.

Pi Tau Sigma Gold Medal Award

The Pi Tau Sigma Gold Medal Award was established in 1938 through an endowment by Pi Tau Sigma, national honorary mechanical-engineering fraternity. It is awarded annually to a young mechanical engineer for outstanding achievement in mechanical engineering within ten years after graduation from a regular four-year mechanical-engineering course in a recognized American college or university. His achievement may be in any field, including industrial, educational, political, research, civil, or artistic.

Any man of good character who on July 1st each year has been graduated not more than ten years from the regular

Seated at head table during President's Luncheon, lead-off social function of the 1956 ASME Annual Meeting, are *left* to *right:* A. C. Mueller, Crosby Field, Ralph Goetzenberger, Ben G. Elliott, Retiring President J. W. Barker (speaking), F. S. Blackall, jr., luncheon toastmaster, Mrs. W. E. Karg, retiring president, Woman's Auxiliary to ASME, J. B. Jones, J. F. Downie Smith, P. F. Martinuzzi, P. W. Swain, and C. Fayette Taylor. Outstanding ASME Lecturers also were cited.

Thousands of Engineers Convene in New York to Attend 1956 ASME Annual Meeting

"Free Exchange of Knowledge—The Path to the Future" keynotes diversified program

The 77th Annual Meeting of The American Society of Mechanical Engineers was held November 25–30, 1956, at the Hotels Statler and Sheraton McAlpin, New York, N. Y., with the theme "Free Exchange of Knowledge—The Path to the Future" as the keynote. Total attendance of engineers, their wives, and guests was 6893 including the registration for the American Rocket Society, an affiliate of ASME, which held sessions concurrently in the Henry Hudson Hotel, and the International Conference on the Fatigue of Metals sponsored by The Institution of Mechanical Engineers (Great Britain) in co-operation with ASME.

The 22nd National Exposition of Power and Mechanical Engineering under the auspices of ASME was held at the same time in the new Coliseum with exhibitions by 275 leading manufacturers and with such innovations as atomic and rockets and missiles sections. By proclamation of Mayor Wagner, the week of Nov. 26–30 was also "automation week," and the Automation Exposition was held at the Trade Show Building.

An "early bird" party was held at the National Arts Club on Sunday for those who had arrived early for the meeting. A panel discussion on engineering education and accreditation was held on Sunday evening.

The Meeting officially opened with the President's Luncheon on Monday, at which Frederick S. Blackall, jr., past-president and Fellow ASME presided while the luncheon address was given by retiring ASME President Joseph W. Barker on the subject "1956—Then What?"

The technical sessions, at which more than 250 papers were presented in 95 sessions, also began on Monday. More than 500 people participated in the International Conference on Fatigue of Metals, in which the papers previously presented in London were summarized by reporters who were specialists in their fields, and who also served as chairmen of the sessions in turn. Meanwhile 1200 members and guests of the American Rocket Society participated in the 11 technical sessions of that group at which 48 papers were presented.

Luncheons and dinners were held during the week by the various divisions of ASME with Wednesday noon reserved for the Members and Students Luncheon and Wednesday evening reserved for the Banquet.

Over 1400 attended the Banquet at which Dr. Barker presided and the Secretary of the Air Force, Donald A. Quarles, delivered the address. Incoming President William F. Ryan and the incoming council members were in-

M. J. Balcerzak

A. J. Morelli

J. W. Jacobson

The Charles T. Main Award was presented at the Members and Students Luncheon, Wednesday, November 28, 1956.

Undergraduate Student Award

Amedeo J. Morelli

The Undergraduate Student Award, established in 1914 from a fund created by Henry Hess, past vice-president of the Society, is presented for the best paper or thesis submitted by a Student Member. The recipient of the 1956 award was Amedeo John Morelli, Associate Mem. ASME, for his paper, "Calculating Machines," entered in competition at the ASME Semi-Annual Meeting in Cleveland, June, 1956.

Mr. Morelli, born in East Orange, N. J., in 1923, was graduated from Bloomfield, N. J., High School in 1940.

He attended Newark College of Engineering during the evening, working days, and received his BS in mechanical engineering in 1956. He is currently enrolled for a master's degree at NCE with a major in electrical engineering.

For the past five years, he has been employed in the research and development department of Monroe Calculating Machine Company doing electromechanical design.

The Undergraduate Student Award was presented at the Members and Students Luncheon, Wednesday, November 28, 1956.

Old Guard Prize

Joseph William Jacobson

The Old Guard Prize, established in 1956, was awarded to Joseph William Jacobson, Assoc. Mem. ASME, for his paper, "Metallurgical Yield-Stress Observation." Winners of this award are selected through a series of regional competitions with a final decision being rendered by a panel of judges at the ASME Semi-Annual meeting. The Award is made possible by members of the Society who, through long membership or age, have reached a dues-exempt status but who contribute funds for worthwhile purposes such as this prize.

Mr. Jacobson was born in San Antonio, Texas, in 1932 and attended school there, graduating in 1950. He enrolled at San Antonio Junior College in 1951 and was graduated in 1953. He then enrolled at the University of Texas and received his BS in mechanical engineering in August, 1956.

He is now employed at the Duquesne Works of the United States Steel Corporation.

The Old Guard Prize was presented at the Members and Students Luncheon, Wednesday, November 28, 1956.

Mr. Jacobson delivered his prize-winning paper during the luncheon and it is published in this issue of Mechanical Engineering, pages 13 to 15.

ASME Lecturers, 1955-1956

The ASME Lectures were instituted to bring to Sections of the Society on a biennial basis, outstanding speakers on subjects of broad general interest and value to members of the profession of mechanical engineering. During the several years that the Lectures have been established, leading engineers have been selected for this service. The selection is, in itself, an honor. The Lecturer donates his time and receives no honorarium.

The following is a list of the 1955-1956 ASME Lecturers and their topics:

Crosby Field, Fellow ASME, president, Flakice Corporation, Brooklyn, N. Y.

Topic: "*The Crowning Contribution of Our Profession.*"

P. Frank Martinuzzi, Life Mem. ASME, professor of mechanical engineering, Stevens Institute of Technology, Hoboken, N. J.

Topic: "*Industrial Gas Turbines.*"

A. C. Mueller, Mem. ASME, Engineering Service Division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.

Topic: "*Practical Aspects of Heat Transfer.*"

Philip W. Swain, Fellow ASME, Consultant in Technical Writing and Speaking, Riverside, Conn.

Topic: "*Imagination—the Key to Engineering Achievement.*"

W. F. G. Swann, Director, Bartol Research Foundation, Swarthmore, Pennsylvania.

Topic: "*The Nature of Research.*"

C. Fayette Taylor, Director, Sloan Laboratories for Aircraft and Automotive Engines, Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Topic: "*Scale and Size Effects in Engines and in Other Mechanical Devices.*"

Certificates were presented at the President's Luncheon, Monday, November 26.

The Lectureships Committee for 1956 was composed of the following personnel:

J. H. Potter, chairman; N. A. Hall, and Dana Young.

The Regional representatives included the following:

C. H. Coogan, Jr., I; K. J. Moser, II; E. H. Hanhart, III; K. P. Hanson, IV; E. W. Jacobson, V; John Gammell, VI; J. K. Salisbury, VII; and C. J. Eckhardt, VIII.

spoke on the proposed survey of the profession. The definitive proposal of the committee which he headed appeared in the December, 1956, issue of MECHANICAL ENGINEERING. The survey was authorized in a resolution passed by ECPD at Toronto about a year ago and is estimated to cost about $1 million. It has been endorsed already by several engineering groups with financial support also pledged by them. It will be the result of a survey which ASEE undertook and which indicated the need for a more complete study.

Most of the discussion, started by the "needling" of Dean J. F. Downie Smith of Iowa State, was concerned with the content of the curriculum—what subjects should be taught, how some should be approached, what should be omitted, what is practical. Creativeness, or synthesis, and communication, both verbal and graphic, were considered over-all important goals, and training will largely determine how and what the engineer creates. Dean Hollister commented that no four-year curriculum can make up for a lifetime of accumulated deficiencies from the home and the school in verbal expression, and the problem is the same for engineering as it is for a liberal-arts curriculum.

The limits of teaching graphic communication were expressed, with general agreement that detailed mechanical drawing is an artisan skill, and the emphasis for engineers should be on understanding and interpretation with preliminary sketches adequate on the preparation side.

Much of the responsibility for the "practicality" of the education rests with the profession, and retiring ASME President Barker stated that on the whole, the manufacturing and practicing engineer had abdicated responsibility. Shop practice was regarded by President Davis of Stevens as something which industry could provide more quickly and efficiently than the colleges.

The growing trend toward graduate study was considered, with little agreement on content, or the desirability of accreditation at that level. Several panel members felt this was an area in which the individuality of an institution's program was best expressed and that the determination of its nature should be an institutional prerogative.

Accreditation could only mean a leveling down of standards and that same danger at the undergraduate level should also be constantly borne in mind.

Dinners and Luncheons

President's Luncheon

At the President's Luncheon, outstanding event of the opening day of the 77th ASME Annual Meeting, outgoing President J. W. Barker urged American industry to throw its weight behind the engineering and science schools of the nation.

"I can state with firm conviction and clear conscience that such support of engineering and science education is less of a gamble with stockholders' money than is the support of research," said Dr. Barker.

He called attention to the fact that educational grants are tax-deductible within the five per cent allowable in Federal corporate income taxes, so that "you start off with odds of 100 to 48, or better than two to one, since every dollar of educational grant costs the company stockholders only 48 cents net after taxes."

Dr. Barker urged that salaries of engineering and science teachers be brought to levels reasonably comparable with industrial salaries for persons of equivalent capabilities and attainments.

"Then," he said, "there would be no need for a ban on raiding, for raiding could go on with equal vigor on both sides—and probably with greater advantages to both industry and education."

To bring this about, he pointed out, engineering and science schools must have real and substantial financial help over and above what is needed to provide increased industrial plant.

In conclusion he stated: "Industry spends, and very properly so, many millions of dollars annually in support of applied research and development aimed at the possibility of capturing the lead for tomorrow's new products. Why should not industry generally follow the lead of some enlightened companies and support also the schools which are producing tomorrow's engineers and scientists?"

Dr. Barker's talk is published on pages 4 to 7 of this issue.

Mrs. W. E. Karg, past-president of the Woman's Auxiliary to the ASME, extended a gracious invitation for active participation in the Woman's Program and related some facts about the various funds for which the Auxiliary is responsible.

Also recognized for their outstanding record of the year 1955–1956 were the ASME Lecturers. The list of Lecturers and topics included: Crosby Field, Fellow ASME, president, Flakice Corporation, Brooklyn, N. Y., "The Crowning Contributions of Our Profession"; P. Frank Martinuzzi, Life Member ASME, professor of mechanical engineering, Stevens Institute of Technology, "Industrial Gas Turbines"; A. C. Mueller, Mem. ASME, Engineering Service Division, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del.,

A group of four Hungarian refugees who had arrived the day before by air from Vienna were special guests at the President's Luncheon where Frederick S. Blackall, jr., urged the members of ASME to see that they get jobs, since two of them are engineers. Stephen Istvan Juhasz, Mem. ASME, explains a point in the program. *Left to right,* Andrew Simon, Civil Engineer; Erno Esztergar, Civil Engineer; Stephen Botond, Architect; Andrew Sik, Technical Translator.

troduced and eight engineering honors and awards were presented. Several Honorary Memberships were also conferred at the Banquet in addition to recognition of the fifty-year Members of ASME.

Inspection trips were taken to biochemical and microbiological laboratories, several manufacturing plants, the air cargo terminal at Idlewild Airport, the construction work for the third tube of the Lincoln Tunnel, and the passenger facilities of the 30,000-ton American Export liner *Constitution*.

The women who attended the meeting had a full program of their own, with tours, luncheons, coffee hours, fashion shows, and dinners when they were not participating in such events of the regular program as the President's Luncheon and the Banquet.

Numerous committee meetings and the reunions of 17 colleges were also held during the course of the Annual Meeting.

Education and Accrediting

On Sunday evening, a panel consisting of three deans of engineering and a college president with a fourth dean acting as authorized "needler," discussed engineering education and accreditation. Retiring ASME President Joseph Barker presided.

Some evaluation was attempted of the present ECPD procedure in accrediting engineering curriculums, and of the curriculums themselves.

Dean S. C. Hollister of Cornell stated that engineering plus management were the dual emphases after World War I, and that in some respects the two were fundamentally opposed. World War II brought completely new technical demands with only elementary thermodynamics, completely new metals, new types of heat engines, new fuels and such special problems as the effect of acoustics on flames. Yet training now is for problems presently faced rather than for the forward-looking approach necessary to meet the problems of 20 to 25 years after graduation. He listed four objectives of training that would make this long-range objective possible: (*a*) Scientific and technical competence; (*b*) anticipation of further developments from present knowledge; (*c*) training of technologists and engineers (the scientist's work is done when the theory has been proved in the laboratory, but the engineer's job is to apply theory and get things done); and (*d*) social consciousness.

Dean Harold L. Hazen of M.I.T. spoke on the accrediting ideals and procedures of ECPD. The purpose is to provide a list of curriculums at the undergraduate level that will boost standards by establishing a minimum floor partially as a basis for the legal requirements of the 48 states, and incidentally of use in high-school counseling.

A careful appraisal of adequate curriculums is most important. The program is carried out by inspecting teams which visit the institutions requesting accreditation, and report to the national ECPD Education Committee, which in turn makes a recommendation to ECPD itself. In this way, the judgment of three separate professionally competent groups is successively brought to bear, with 35 to 40 individuals represented in the final two steps. Major considerations are, above all, the quality of the faculty and the scientific foundation of the training. The American Society for Engineering Education has been an active body in the formulation of policy and ideals and made a report about a year and a half ago. Most wanted, and most difficult to get in workable form, are the suggestions of practicing and manufacturing engineers.

President Jess Davis of Stevens spoke on the responsibilities and opportunities of ASME in engineering education and ECPD accreditation. ASME, he said, should pay more attention to education and set some of the policy for ECPD. The Society should decide what are the distinguishing features or characteristics of a mechanical engineer and how they can best be achieved in an educational program. More communication to the membership is needed regarding the educational picture and problems. Some of the inadequacies noted on inspection visits are: Machine-design teaching is still based on the old punch-press techniques in some institutions. Much thermodynamics content is a throwback to the days when steam power-plant design was paramount. Vibrations are ignored by many and notes dated 1921 and 1927 are still being used by some. Steam-engine testing should give way to some combustion and heat-transfer problems. The areas and kinds of work for which ME's are used should be studied and the diversity of interests of ME's is one factor in deterring the progress of ME education. He asked what should be done about teaching creativeness and commented that there seems to be a negative correlation between education and creation. Part of the difficulty is in finding people with broad-gage minds and good personalities.. He emphasized that science should be taught from the engineering standpoint in an engineering curriculum, and that the major difference between science and engineering is the time lag between discovery and use.

Dean Thorndike Saville of N.Y.U., and ECPD president for 1955–1956,

Panel for the Sunday evening discussion on "Engineering Education and Accrediting," seated *left to right,* President Jess H. Davis, Stevens Institute of Technology; and three deans of engineering: Dean S. C. Hollister of Cornell, Dean Harold L. Hazen of M.I.T., and Dean Thorndike Saville of N. Y. U. ASME President Barker who presided is standing, and Dean J. F. Downie Smith of Iowa State,and Director ASME, not shown, who was authorized "needler," completed the group.

William S. Major, Mem. ASME, project engineer, machinery division of the Dravo Corporation, Pittsburgh, Pa., presided.

Management Luncheon

William L. Batt, a past-president and Hon. Mem. of ASME, called for a large, bold, and imaginative program of foreign aid with no political strings attached. He told an audience at the Management Luncheon on Tuesday that he was "keenly disturbed" at what is happening in the world today. He said he felt that the situation was more perilous for the United States today than it was in 1948, when the Marshall Plan was conceived, or even than it was in 1940, when, he said, the American people seemed little concerned with their nation's coming committments to the rest of the world.

Dr. Batt was vice chairman of the War Production Board during World War II. From 1950 to 1952 he was United States representative on the NATO Defense Production Board and chief of the ECA mission to Great Britain.

He charged that the situation in Egypt might have been "very different" if the Aswan Dam issue had been handled differently.

"We must have people running foreign aid who have a deep conviction as to its effectiveness," he said.

He concluded by expressing hope that President Eisenhower will go before the 85th Congress with a substantial request for foreign aid.

He said, "I want to sharpen your interest in a program of technical assistance on a very much larger level than the Marshall Plan. We must be ready to do something bigger than anybody else has up to this time. But we must stop tying so many strings to our aid, especially political strings. The American people must take it for granted that a peaceful world is in their interest."

H. N. Muller, Jr., Mem. ASME, Director of Engineering, Canadian Westinghouse Company, Ltd., Hamilton, Ontario, Canada, presided.

Heat Transfer Luncheon

The great need for more energy which exists in some countries could be solved with solar radiation, said Dr. Peter Courvoisier, research physicist of the Davos Observatorium, Davos, Switzerland, at the Heat Transfer Division Luncheon on Tuesday. Many countries in the so-called sun belt of the world are far behind others in technological development and standard of living. They have little or none of the fuels which are ordinarily used to run engines in the more industrialized countries of the world. Although atomic energy might be possible for them, it has not yet been fully developed, and is perhaps too technically advanced for countries without technical development of any kind. They do have solar radiation in abundance, however, and all that is needed is a way of utilizing it.

Dr. Courvoisier then outlined a simple and rather primitive engine which would work on radiant energy. Flat-plate collectors receive the radiant energy and change it into heat, which is then turned into mechanical power. Only about 15 per cent of the radiant energy can be transformed. This seems like a low efficiency until it is remembered that there is, in these regions, an almost unlimited amount of solar energy to be utilized.

This engine needs to be built and tested, and Dr. Courvoisier called on engineers to study the problem, to do engineering research on it, and to find useful applications for it in the less well-developed countries of the arid sun belt.

Myron Tribus, Mem. ASME, chairman of the Heat Transfer Division, presided at the luncheon.

Applied Mechanics Dinner

The Applied Mechanics Division gave a dinner on Tuesday evening that will be remembered with pleasure. Held at the Men's Faculty Club of Columbia University, it was devoted primarily to honoring Professor John M. Lessells, Hon. Mem. ASME, on his retirement after 21 years as Technical Editor of the *Journal of Applied Mechanics*.

R. D. Mindlin, chairman of the Executive Committee of the Division, presided at the event. After a brief introductory talk, Prof. Mindlin introduced Otto de Lorenzi, the outgoing chairman of the ASME Publications Committee, and also Douglas G. Sopwith, Mem. ASME, and director of the Mechanical Engineering Research Division of the National Physical Laboratory, Glasgow, Scotland.

Professor Mindlin then greeted from the audience the new Technical Editors of the *Journal*—Dr. D. C. Drucker, chairman of the Division of Engineering,

W. L. Batt, *left,* Fellow and Hon. Mem. ASME, and H. N. Muller, Jr., Mem. ASME, director of engineering, Canadian Westinghouse Company, Ltd., Hamilton, Ont., Canada, at the Management Luncheon

Peter Courvoisier, *left,* research physicist, Observatorium Davos, Davos, Switzerland, Heat Transfer Luncheon speaker on "The Utilization of Solar Energy," and Myron Tribus, Mem. ASME, and Chairman

"Practical Aspects of Heat Transfer"; Philip W. Swain, Fellow ASME, consultant in technical writing and speaking, Riverside, Conn., on "Imagination—the Key to Engineering Achievement"; W. F. G. Swann, director, Bartol Research Foundation, Swarthmore, Pa., "The Nature of Research"; and C. Fayette Taylor, director, Sloan Laboratories for Aircraft and Automotive Engines, department of mechanical engineering, Massachusetts Institute of Technology, "Scale and Size Effects in Engines and in Other Mechanical Devices."

Also introduced were the members of Council who have completed their term of office. Included in this group were: J. B. Jones, Vice-President, Region IV; Ben G. Elliott, Vice-President, Region VI; J. F. Downie Smith, director (T); R. L. Goetzenberger, director (A); and F. S. Blackall, jr, past-president. Two members of Council were held over by virtue of the fact that they were re-elected as Vice-Presidents of their respective Regions; they are W. H. Byrne of Region II and C. H. Shumaker of Region VIII.

F. S. Blackall, jr., past-president and Fellow ASME, served as toastmaster at the luncheon.

Nuclear Engineering Dinner

C. Rogers McCullough, on leave from Monsanto as deputy director of hazards evaluation, U. S. Atomic Energy Commission, spoke on "The Design of Reactor Systems for Safety," at the Nuclear Engineering Dinner on Monday. Safety, he stated, has to be designed into reactors and the place of proper design cannot be taken by any amount of attached gadgets or devices. No lives have been lost in the United States from commercially operating reactors and serious accidents in experimental operations have been few. Although there is undoubtedly overcaution, it is not to the extent that would have prevented the industrial revolution if comparable precautions had been observed in the original experiments with steam boilers.

Dr. C. Rogers McCullough, deputy director, Hazards Evaluation, U. S. Atomic Energy Commission, spoke on "The Design of Reactor Systems for Safety" at the Nuclear Engineering Dinner

The consequences to life and property from a serious disaster are so great that chances cannot be taken; particularly since hidden or undiscovered hazards must exist in spite of all attempts to anticipate them and the 28 major tests which have to be considered in the design. The most likely time for operational disaster would be in transients during the loading or reloading of fuel, and the principal hazard is loss of control of the rate of flux.

The sudden surges in temperature which this creates can melt the reactor vessel. The emphasis placed on cooling makes standards for pumps, fittings, and materials used in coolant circuits much more critical than those for use with ordinary fuels where the penalty for failure is not so great. In spite of this, standards must not be set so soon that they will act as a millstone on progress. Simultaneous failure in the auxiliary equipment to the reactor proper must be considered. The degree of caution observed in backing up this equipment with reserves lies somewhere in the anticipation of two to ten simultaneous failures with ten statistically and economically ridiculous and two insufficient.

John R. Dunning, Mem. ASME, Dean of Engineering, Columbia University, New York, N. Y., acted as toastmaster.

Fuels Luncheon

Coal production will reach one billion tons by 1975 according to Dr. Clyde Williams, Mem. ASME, director of Battelle Memorial Institute, Columbus, Ohio, the speaker at the Fuels Luncheon on Tuesday.

"A 50 per cent increase in population, if standards remained static, would mean a 50 per cent increase in fuel consumption by 1975. That alone would press the petroleum and gas industries to supply demand, and should easily step up bituminous coal production to an annual rate of 750 tons.

"To say that our present high fuel production will be doubled in 20 years is optimism, true, but it is well-bridled optimism. This estimate could very readily be on the low side. It assumes that our future record will be no better (in fact, even poorer) than it has been in the past 20 years."

Dr. Clyde Williams, Hon. Mem. ASME, president and director, Battelle Memorial Institute, Columbus, Ohio, speaker at the Fuels Luncheon on the topic "The New Look for Fuels and Power"

Other factors that are not considered in this estimate which might make it conservative are the trend to the use of materials that require more energy per unit weight or volume for their production and fabrication, such as aluminum, synthetic building materials, plastics, and synthetic fibers. Increased electrification, increased mechanization and other changes in processing, and exports of coal will all contribute, he said.

"Before 1930, petroleum and gas supplied 31 per cent and coal 66 per cent of the nation's total energy requirements. Now the relation is reversed and oil and gas supply 67 per cent, and coal only 29 per cent. Owing to our dynamic economy and its dependence on mechanical and electrical energy, demand for all fuels will continue at an increasing rate, and while petroleum and gas will be in increased demand, generally, the need for coal should be particularly great in electric-power generation. Moreover, technological advancement will make coal more competitive, especially among large-tonnage users. The most promising of these developments are advancements in mining, preparation, handling, and transportation. In the latter case the proposed network of pipelines to carry coal under water pressure seems to be especially significant."

awarded to J. Keith Louden, Fellow ASME, "for his distinctive permanent contribution toward the advancement of scientific management as exemplified by his comprehensive book, 'Wage Incentive.'"

The ASME George Westinghouse Gold Medal went to Perry W. Pratt, Mem. ASME, "Leader in the field of aircraft propulsion, whose foresight, keen vision, and direction have contributed greatly to development of modern aircraft engines which achieve power concentrations and efficiency undreamed of only a few decades ago."

The ASME Medal was presented to Harry F. Vickers, Mem. ASME, "Pioneer in the development of industrial and military applications of oil hydraulics and a leader in the field of business."

Honorary Membership was conferred on three engineers of world fame as follows:

Charles W. E. Clarke, Fellow ASME, "Acknowledged leader in the field of steam-power generation and outstanding contributor to progress in that field during the past half century."

William F. Gibbs, Fellow ASME, "Eminent naval architect and marine engineer, whose wisdom and courage in new undertakings provided leadership to the nation in time of need and whose persistence and enthusiasm accomplished the seemingly impossible."

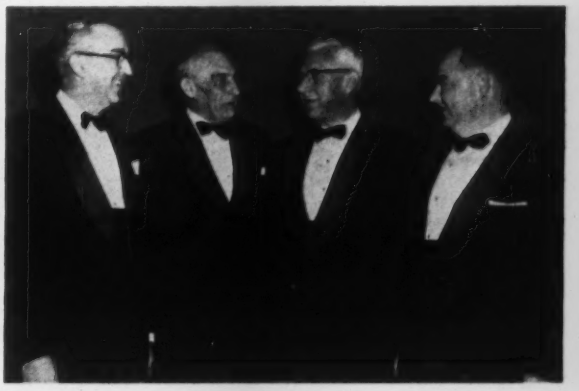
S. C. Hollister, Mem. ASME, "Eminent engineer, educator, and administrator, whose efforts to improve engineering education and direct attention toward educational problems have permanently enriched the profession."

Further details concerning the recipients will be found in the article, "ASME Honors Engineers," on pp. 68 to 74, in this issue.

Secretary Quarles—Banquet Speaker

Secretary of the Air Force Donald A. Quarles discussing air power, the keystone of our national security, reaffirmed the United States' "determination to use" nuclear weapons if necessary against communist aggression.

ASME Presidents, outgoing and incoming, congratulate three distinguished engineers who were honored by the Society and upon whom honorary membership was conferred. *Left to right:* J. W. Barker, outgoing President ASME; the three recently elected honorary members, W. F. Gibbs, S. C. Hollister, C. W. E. Clarke; and ASME President W. F. Ryan.



Internationally famous engineers who were awarded medals by ASME are greeted by J. W. Barker. They are, *left to right,* J. Keith Louden, recipient of the Worcester Reed Warner Medal; J. W. Barker, outgoing ASME President; H. F. Vickers, winner of the ASME medal; and P. W. Pratt, who was awarded the ASME George Westinghouse Gold Medal.

M. S. Gjesdahl, *center,* representing the president of Pi Tau Sigma, presents the Richards Memorial Award to E. M. Barber, *left,* for outstanding achievement in mechanical engineering within 20 to 25 years after graduation, and J. A. Clark, *right,* winner of the Pi Tau Sigma Gold Medal Award for outstanding achievement in mechanical engineering within ten years after graduation

F. S. Blackall, jr., past-president and Fellow ASME, presents the Blackall Machine Tool and Gage Award to O. W. Boston, *left,* and W. W. Gilbert, *right.* The Blackall Award was established to foster interest in the design or application of machine tools, gages, or dimensional measuring instruments. The first award was made in 1955 at the ASME Diamond Jubilee Annual Meeting.

Professor John M. Lessells, Fellow and Hon. Mem. ASME, speaks in appreciation of the Certificate of Award presented to him upon his retirement after 21 years as Technical Editor of the *Journal of Applied Mechanics*. The dinner in his honor was given at the Men's Faculty Club of Columbia University. Seated, *left to right*, Otto de Lorenzi, outgoing chairman of ASME Publications Committee, Professor R. D. Mindlin of Columbia, chairman of the Applied Mechanics Division, Miklos Hetenyi, Mem. ASME, D. G. Sopwith of E. Kilbride, Scotland.

Brown University, and Dr. Joseph Kestin, professor of engineering at Brown.

The high light of the evening was the presentation of a Certificate of Award to Prof. Lessells for his services as Technical Editor of the *Journal of Applied Mechanics*, a post he had held since 1935.

Prof. de Lorenzi, who presented the Certificate, pointed out how Professor Lessells had brought to the magazine the benefits of many years of experience as a practicing engineer both in England and the United States. Prof. Lessells, he said, will still continue to serve the *Journal* in the capacity of Honorary Editor.

Annual Banquet

Before a banquet audience of 1400 engineers and their guests, the Society conferred its highest honor on three eminent engineers, presented awards to others for their outstanding contributions to engineering, saluted honored guests, and had the opportunity to hear Secretary of the Air Force Donald A. Quarles discuss air power, the keystone of our national security. Retiring ASME President J. W. Barker acted as toastmaster.

The invocation was given by Carl J. Eckhardt, Fellow ASME, professor of mechanical engineering, University of Texas.

On opening the proceedings of the dinner, the feature social function of the 77th Annual Meeting devoted to the theme of "Free Exchange of Knowledge —The Path to the Future," Dr. Barker lauded the work of the more than 400 authors and the many others who made the sessions possible. In fact the program is a great demonstration of the free exchange of knowledge, he added.

In all, he stated, 2000 individuals contributed time and effort to the success of the meeting.

"The results of their work," he concluded, "will flow into our publications so that engineers of the world may learn."

Then two representatives of societies with which ASME has extremely close relations were introduced. They were: Douglas G. Sopwith, representing The Institution of Mechanical Engineers (Great Britain) and chairman of the committee which arranged the International Conference on Fatigue of Metals, an integral part of this Annual Meeting, and Noah S. Davis, president of the American Rocket Society, an affiliate of ASME. Dr. Barker then called on C. E. Davies, secretary ASME, to introduce the distinguished guests from various professional and learned societies.

Fifty-Year Members of ASME were recognized. Of the 15 members so honored, three were present; namely, Arthur Brewer, F. H. Hirschland, and C. T. Reed. The following were unable to attend: G. M. Campbell, C. C. Crawford, Aldrich Durant, C. C. Egbert, G. H. Gleason, W. H. Harman, M. R. Kennedy, T. H. Miller, Egbert Moxham, J. T. Ramsden, R. B. Renner, and C. H. Schlachter.

The members of the Old Guard were asked by Dr. Barker to rise so that all could see the group performing such impressive work with the students and younger members throughout the country. He then introduced Joseph W. Jacobson, winner of the national Old Guard Prize.

Incoming Council members, vice-presidents and directors, were then introduced as follows: W. H. Byrne, E. W. Jacobson, J. H. Sams, C. H. Shumaker, V. Weaver Smith, and R. S. Stover.

Dr. Barker then introduced William F. Ryan, ASME's incoming President. Mr. Ryan expressed his thanks to the Society for having been placed in this office of great prestige. He added that the Society's publications are the most useful and sought after in the world. Further he asked for recognition for what George A. Stetson had accomplished as editor of ASME publications. This tribute to Mr. Stetson was enthusiastically received with a standing round of applause. Dr. Ryan then presented the diamond symbol of office to Dr. Barker.

Honors and Awards

The bestowal of honors, high spot of the evening, commenced with two awards given jointly with Pi Tau Sigma. John A. Clark, Assoc. Mem. ASME, received the Pi Tau Sigma Gold Medal Award "for outstanding achievement in mechanical engineering within ten years after graduation." The Richards Memorial Award went to Everett M. Barber, Mem. ASME, "for outstanding achievement in mechanical engineering within 20 to 25 years after graduation."

The Prime Movers Committee Award was accepted by R. B. Donworth, Mem. ASME, for himself and W. J. Lyman, I. Harry Mandil, N. J. Palladino, Mem. ASME, Milton Shaw, and J. W. Simpson, Mem. ASME, "for their paper, 'Description of the Pressurized Water Reactor (PWR) Plant at Shippingport, Pa.'"

The first Arthur L. Williston Award was presented to J. A. Welsh, Assoc. Mem. ASME, "for his paper, 'Building Character in Undergraduates.'"

The Blackall Machine Tool and Gage Award went to O. W. Boston, Fellow ASME, and W. W. Gilbert, Mem. ASME, "for their paper, 'Forces and Power Required to Turn Aluminum and Seven Alloys.'"

The Worcester Reed Warner Medal was

ASME President Barker, *center,* who presided at the Members and Students Luncheon; *left,* John Andrew Welsh, instructor at M.I.T., who received the Arthur L. Williston Medal and Award for his paper; and *right,* John A. Clark, Assoc. Mem. ASME, an assistant professor at M.I.T., who delivered the address on "Science and the Spirit." The awards for student papers were also presented.

Winners of student awards for outstanding papers, *left to right,* Joseph William Jacobson, Assoc. Mem. ASME, University of Texas, '56, winner of the Old Guard Prize; Marion John Balcerzak, Assoc. Mem. ASME, University of Detroit, '56, winner of the Charles T. Main Award; and Amedeo John Morelli, Assoc. Mem. ASME, Newark College of Engineering, '56, winner of the Undergraduate Student Award

generation has accomplished and what they think. J. W. Barker, the outgoing ASME President, presided.

Dr. Barker presented the guests at the head table and then called on William F. Ryan, incoming ASME President, to address the assemblage briefly.

This luncheon is also the time when the beacon is sighted on the young men of the Society who have been honored for their contribution to the Society and to the profession. First to be introduced was the initial recipient of the Arthur L. Williston Medal and Award, John A. Welsh, graduate of Massachusetts Institute of Technology and presently an instructor at M.I.T., for his paper "Building Character in Undergraduates."

Dr. Barker called on J. Stanley Morehouse, chairman, Board on Honors, to present the recipients of awards. Those honored included: Amedeo J. Morelli, who received the Undergraduate Student Award for his paper "Calculating Machines"; Marion J. Balcerzak, who won the Charles T. Main Award for his paper "The Modern High-School Program as a Preparation for Engineering Education"; and J. William Jacobson, recipient of the Old Guard Prize for his paper "Metallurgical Yield Stress Observation."

The members of the Old Guard were asked to rise so that all might see the group who are doing so much to help the Student and Associate Members during their formative years. They were applauded enthusiastically. Then Dr. Barker paused to relate how impressed he had been with the presentation of the excellent technical papers delivered by the winners of Regional Old Guard Prizes at the Semi-Annual Meeting of the Society in Cleveland, Ohio, last June. He then called on J. William Jacobson to present his paper, which is published in this issue of MECHANICAL ENGINEERING, pages 13–15.

John A. Clark, winner of the Pi Tau Sigma Gold Medal Award, delivered his paper entitled "Science and the Spirit."

The presentations were highlighted by comparing the two papers. The first, highly technical, described how an engineer devised apparatus to deal with metallurgical failure; the second set forth that scientists can realize their greatest creative success where their religious or spiritual freedom is assured.

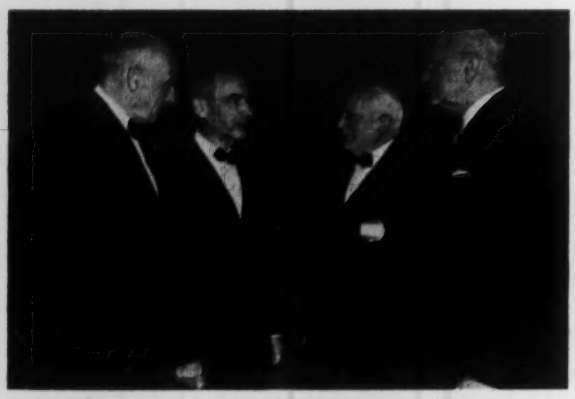
Wood Industries Division and Luncheon group, *left to right,* W. B. Wilkins, F. J. Hanrahan, T. D. Perry, R. B. Pollman, L. A. Patronsky

Wood Industries Luncheon

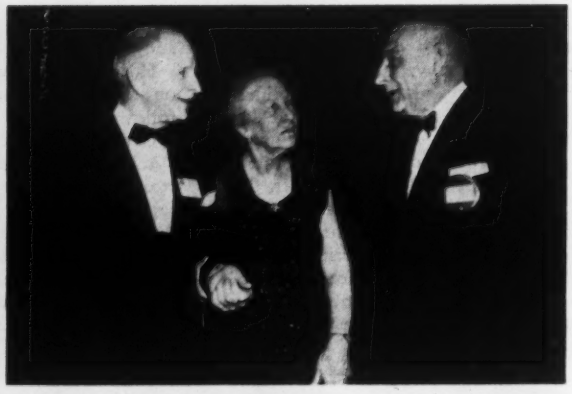
The concept of prefabrication is changing to take in all components of a house, declared Richard B. Pollman, in his talk entitled "Wood Prefabricated Housing Developments."

Mr. Pollman, chairman, Prefabricated Home Manufacturers Institute Development Committee, Scholtz Homes, Inc., Toledo, Ohio, said that engineering and design techniques have resulted in more and more components that will fit together easily at the building site with a minimum of labor and finishing required.

With more than a million or so homes being built each year since the war, he said, the most recent figures show that about 16 per cent of all homes being built were solid masonry construction, most of this with brick facing. Frame construction accounted for 84 per cent and



Principal banquet speaker receives official welcome. *Left to right:* J. W. Barker, retiring ASME President; Secretary of the Air Force Donald A. Quarles, who in his talk reaffirmed the United States' "determination to use" nuclear weapons if necessary against communist aggression; ASME President W. F. Ryan; and C. E. Davies, secretary, ASME.



Distinguished visitors at the Annual Banquet included L. Austin Wright, *left,* General Secretary and Editor of the Engineering Institute of Canada, and Dr. Lillian M. Gilbreth, Hon. Mem. ASME and world-famous management consultant. They are welcomed by J. W. Barker, outgoing President of ASME, during the reception preceding the banquet.

R. B. Donworth, *left,* **receives the Prime Movers Committee Award for himself and the other five recipients. He is shown with Mrs. N. J. Palladino and her husband, who was one of the six recipients. Mrs. Palladino graciously consented to represent the recipients who were unable to attend the banquet. They are W. J. Lyman, I. H. Mandil, Milton Shaw, and J. W. Simpson.**

Leading engineer guests at banquet include N. S. Davis, president, American Rocket Society, an affiliate of ASME; D. G. Sopwith, representative of The Institution of Mechanical Engineers (Great Britain) and chairman of committee which arranged International Conference on Fatigue of Metals; ASME President W. F. Ryan; and V. A. McKillop, president, The Engineering Institute of Canada.

"Any thought that under present conditions nations will rule out a nuclear war or any other kind of war on moral grounds ignores the lessons of history, some of which are recent history," he stated.

Further he added the following:

The Air Force has "at this time a clear margin of qualitative superiority over communist military strength" both in personnel and equipment.

The service "has approximately 1000 planes in the air every minute around the clock" in simulated strategic and tactical bomb runs, air defense, rescue, and transport missions.

In discussing new equipment, he pointed out that the new all-jet B-52 heavy bombers, replacing the B-36's, are "the foremost expression of air power in the world today"; the supersonic B-58 medium bomber is being flight-tested, and the Air Force is "working on even more advanced versions of manned bombers using both chemical and nuclear power for propulsion."

Experiments are under way with "two long-range air-breathing pilotless aircraft types" of guided missiles, while two alternatives for an intercontinental ballistic missile and another of intermediate range are "moving ahead at high priority."

"Comparable progress" is being made on "a whole new family of supersonic planes for fighter-bomber and fighter-interceptor missions."

Stressing that the Air Force's might ranges from million-ton nuclear weapons for total war down through "rockets, napalm, and bullets" for more limited tasks, Secretary Quarles said: "To keep this force clearly effective as a deterrent to communist exploitation of its military might is the prime and indispensable requisite of our security."

Members and Students Luncheon

One of the really significant events of the Annual Meeting is the Members and Students Luncheon—where the newest members are presented to the members of the Society. On this occasion two young men were singled out for the opportunity to show what the younger

Attendance at the joint Nuclear Engineering-Power Division sessions exceeded all expectations and more than filled the McAlpin Ballroom

City at Indian Point will be the first commercial unit to use thorium as the fertile material to supplement the base fuel U-235. The 140,000-kw capacity of the plant will be boosted to 236,000 kw by superheating the saturated steam leaving the reactor in separate oil-fired units, effecting an appreciable decrease in the cost of plant per unit of capacity, with a total cost of $55 million.

The 156,000-kw Enrico Fermi Atomic Power Plant being built in Michigan, which chairman Philip Sporn termed a "bolder step forward in the design of an atomic power plant," is of the fast-breeder reactor type and will produce 20 per cent more plutonium than the U-235 it will destroy. Two nonprofit New York membership corporations are financing the reactor and Detroit Edison is building the electric-generating facilities at its own expense.

The proposed 75,000-kw sodium-graphite reactor for the Consumers Public Power District of Nebraska is a low-pressure high-temperature liquid-metal-cooled system using solid fuel and solid moderator. It can be adapted to a variety of fuel elements and operating conditions. Either slightly enriched uranium or a thorium-uranium fuel may be used.

The Pennsylvania Advanced Reactor, leading to the design of a 150,000-kw plant scheduled for commercial operation in 1962, is altogether different from the previous five, being of the aqueous-homogeneous type in which fuel, moderator, and coolant are physically intermixed in a slurry. The light or heavy-water moderator carries the fissionable material either in solution or suspension, and the whole circulates through a piping complex consisting of a reactor vessel, a heat exchanger, and a pump. The technology of this type is relatively unadvanced, and experiments with several variations in design will be made to determine technical feasibility problems that are yet to be solved, and the comparative advantages of the types.

Power. Details of the new supercritical-pressure Eddystone Plant being built for the Philadelphia Electric Company were presented in papers dealing with the overall design and specific details on the superpressure unit and steam generator. The plant will use 5000-psi 1200-F steam to produce 325,000 kw of electricity as compared with the 120,000-kw turbogenerator with steam conditions of 4500 psi and 1150 F in the first supercritical-pressure power plant in this country, recently placed in operation by the American Gas and Electric Company at the Philo Station. The pressure chosen was based on the fact that little was to be gained by exceeding 5000 psi, and the problems to be faced at this pressure appeared to be sufficient for the time being. Two reheats are employed, the first at about 1150 psi and the second at about 275 psi with the reheat temperature set at 1050 F, the practical limit for ferritic steels.

Eight years of experience with austenitic steels have proved them to be good materials for heavy-wall steam piping operating at temperatures above 1000 F and under high pressure, it was stated in a joint Power and Metals Engineering Division session. During this period, Public Service Electric & Gas Company of Newark, N. J., has used 280 tons of these materials, principally AISI types 347 and 316, stabilized with columbium in seven generating units of three power stations and is now using them in its eighth unit in a fourth station.

Ultrasonics can be used to indicate audibly or visibly when flaws exist in metal which might lead to disastrous failures and explosions. A joint Power and Safety Division session heard the history of this new method of inspecting mechanical equipment and welds and the need for standards to extend its use to industry.

Machine Design. The high-speed computer offers a new tool to the design engineer that may ultimately lead to complete automation of the engineering job on relatively standard products all the way from customer specifications to the final product. Fortunately for employment, that is still a long way off, but the appli-

Authors of the three papers on the Eddystone supercritical-pressure power station which were presented at a Power Division session discuss some of the unique design problems. ***Left to right*** **are: J. H. Harlow, Mem. ASME, Philadelphia Electric Company; C. C. Franck, Sr., Mem. ASME, Westinghouse; E. M. Powell, Mem. ASME, Combustion Engineering, Inc., New York, N. Y.**

26 per cent of the total were veneered with brick; 93 per cent were one-story houses and 7 per cent, two-story. Prefabrication accounts for 8 to 10 per cent of the total volume.

He also said that specialized prefabrication of single components should hasten the day when complete standardization of all dimensions of parts and products will be necessary.

He predicted that increasing acceptance of the techniques of component prefabrication would result in reducing the number of builders erecting the total volume of homes required, and in accelerated schedules for home building, with each structure taking less than 30 days from start to finish.

W. B. Wilkins, outgoing chairman of the Wood Industries Division, served as chairman of the luncheon. He was presented with a certificate in testimony of the high regard of his co-workers and the deep appreciation of the Society for his valued services in advancing the work in this field by L. A. Patronsky, incoming chairman.

Chester Babcock, Meetings Program chairman, announced that the 1957 Wood Industries Conference would be held at the Robert E. Lee Hotel, Winston-Salem, N. C., May 16–17. He stated that two interesting plant trips are scheduled; one to the B. F. Huntley plant and the other to the Stanley Furniture Company, Stanleytown, Va.

Textile Engineering Luncheon

Some of the problems encountered in trying to gather data—truthful data—from employees by the interview method were discussed by Stanley Peterfreund, partner, Douglas Williams Associates, at the Textile Engineering luncheon. He said he found people basically truthful even though much of their behavior is questionable. This he found to be true because the interview deals with people as individuals away from their group. It is the group behavior which the speaker has found to be less honest than the individual behavior. Most employees think of their company as an impersonal thing and do not consider it dishonest to try to beat the company. They often hold back on time studies and spoil production studies because they feel that an impersonal company will use the results to their disadvantage. Some employees will pilfer tools and raw materials. However, Mr. Peterfreund said, the employee does not think this is dishonest. It is part of his group behavior as an employee.

If the management of the company desiring information is sincere, and if the interviewer is well trained and genuinely interested in the interviewee as a person, the employee is made to feel that he can talk freely and that he is being treated as an individual. His group behavior is replaced by his individual behavior and he is honest about the facts and problems of his job. Personal interviews of this sort must be followed up by positive action by the company, or by letting the employees know the results of the interviews, in order to be really successful.

As part of the luncheon program, Harold W. Ball, the chairman of the division, presented Robert M. Jones, of the Saco-Lowell Shops, with a certificate in commemoration of his services on the executive committee of the division from 1952 to 1956.

Stanley Peterfreund, *left*, Douglas Williams Associates, New York, N. Y., who delivered the luncheon address at the Textile Engineering Luncheon, and Harold Ball, *right*, Mem. ASME, chief engineer, Foster Machine Company, Westfield, Mass.

Technical Program Highlights

The number of new developments in this year's Annual Meeting was unusually large, with the field of nuclear engineering which was until recently largely in the realm of theory, assuming practical engineering significance in several divisions. While no one could attend nearly all of the sessions or hear many of the 250 papers that were presented, no one could listen to any reasonably large sampling of them and feel that the 77th Annual Meeting had not been worthwhile. Some of the high points from the extensive program follow:

Nuclear Power. Overflow attendance was recorded at the two joint Nuclear Engineering and Power Division sessions at which the features of six nuclear power stations were presented. Three of them are variations of the pressurized-water-reactor type, and represent attempts to bring the design of this type of reactor into commercial competition with conventional steam plants.

The Yankee Atomic Electric Plant is being built in Massachusetts by twelve major New England utilities who produce 90 per cent of the power in the region, with the Atomic Energy Commission financing $5 million of the $35 million estimated cost, and Westinghouse, the contractor, sharing any excess with Yankee, according to formula.

The Dresden Nuclear Power station is being built in Illinois entirely with private financing from a group of midwestern utilities and one west coast company at a cost of $45 million and capacity of 180,000 kw against 134,000 for Yankee. Both are dual-cycle cooled, and fueled with uranium oxide, although in different form.

The proposed Consolidated Edison Nuclear plant to be built on the Hudson River about 24 miles north of New York

Charles T. Chave, Mem. ASME, chief engineer, Nuclear Projects, Stone & Webster Engineering Corporation, Boston, Mass., presents comments on nuclear engineering papers at a joint Nuclear Engineering-Power session. John Dunning, chairman, is seated.

Bruce C. Gunnell, Mem. ASME, consulting engineer and railway supply representative presented a progress report on the development of an atomic-powered locomotive

Paul Speer, head mechanical engineer for Armour & Company, Chicago, Ill., outlined the nature of materials handling of bulk materials in the meat-packing industry

Prof. A. L. London of Stanford, Mem. ASME, presented the paper on heat transfer of which he was coauthor with Long S. Tong, engineer, Westinghouse Electric Corporation

stable forms at fabrication temperatures up to 550 F. It is resistant to hydrolysis in slightly acidic or alkaline environments, and an unsupported valve made of the material had been subjected to 60-lb steam pressure at 320 F for 18 months without change in dimensions. Many other applications are suggested.

Research in plastics is producing new materials so fast that products become obsolete before all their uses have been determined. Production is currently running at the rate of $3\frac{1}{2}$ billion pounds a year, an increase of 26 per cent over last year, for a value of $1.8 billion, or about $\frac{1}{2}$ of one per cent of the gross national product, with estimates of 1960 production at about 7.2 billion pounds, according to an industry survey.

Railroads. Although the diesel prime mover continues to dominate the railroad picture throughout a great portion of the world, the railroads are not neglecting the future, and experiments with an atomic-powered locomotive continue. Shock absorbers that take the bounce out of fast-moving railroad freight cars are helping to eliminate the damage to fragile freight, and will be one of the features of the 500,000 new freight cars that the United States will need during the next five years.

A combination freight vehicle adaptable for use as an individual unit on public highways or in long trains on railroad tracks will go into initial production of about 150 units during the last half of 1957, and some of the lightweight trains or cars that were in the talking stage in 1955 are now in revenue or experimental service.

A radically new design has been proposed in Argentina with a principal feature being pneumatic tires riding on broad-flanged rails with guidance provided by small wheels contacting the sloping underside of the rail on which the supporting wheels ride. It is claimed that, with this design, weight plays no role in stabilizing the cars which can be as light as 200 lb per seat.

It is questionable whether an atomic-powered locomotive can be justified on American railroads at present, but the military advantages of refueling only once in six months, and the potential demand in foreign countries where fossil fuels are in short supply, motivate continued research. The development cost of the first atomic-powered locomotive would probably be at least $20 million and the mass-produced cost about $1 million for the first 500 locomotives compared with present costs of about $300,000 for two-diesel units. One comment was to the effect that after the initial 500 units, costs should drop to the diesel level, just as the diesel had become predominant after being uneconomic for the first 500 units.

Nuclear energy is already being used in another way by the railroads. Radioisotopes are furnishing an inexpensive means for radiographic examination of

Symposium on "Materials Handling Methods" at the joint Materials Handling-Production Engineering-Management session, *left to right*, Frederick Marich, Mem. ASME, engineer, General Foods Corporation, White Plains, N.Y.; Carroll W. Boyce, Assoc. Mem. ASME, assoc. editor, Factory Management & Maintenance Magazine, McGraw-Hill Publishing Company, New York, N.Y.; Andrew W. Jenike, Mem. ASME, consulting engineer, Salt Lake City, Utah; Terry L. Carter, Mem. ASME, consulting engineer, Basic Methods, Inc., Short Hills, N. J.; Irving M. Footlik, Mem. ASME, president, Irving M. Footlik & Associates, Chicago, Ill.

Philip Sporn, Fellow and Hon. Mem. ASME, president of American Gas & Electric Service Corporation, New York, N. Y., chairman of the joint Nuclear Engineering-Power session

John C. Somers, Mem. ASME, president of Industrial Products Engineering Company, Long Island City, N. Y., outlined the mass-production uses of materials handling in product finishing

W. M. Keller, Mem. ASME, vice-chairman and director of research, Association of American Railroads Laboratory, Chicago, Ill., discussed railroad uses of radioisotopes for testing materials

Several applications of digital computers to designing problems were presented at a joint Machine Design-Applied Mechanics session. *Left to right,* Lewis D. Conta, Mem. ASME, professor of mechanical engineering, University of Rochester, chairman; Frank R. Heath, Assoc. Mem. ASME, supervising engineer, Computing Section, Westinghouse Electric Corporation, Kansas City, Mo.; Joseph T. Lester, Jr., Assoc. Mem. ASME, research engineer, Mechanical Development Laboratory, E. I. duPont de Nemours & Company, Inc., Wilmington, Del.; Everett E. Zwicky, Jr., turbine stress analysis engineer, General Electric Company, Schenectady, N. Y.; Walter B. Moen, Mem. ASME, section head, Air Reduction Co., Inc., Murray Hill, N. J., vice-chairman.

cation of the computer to design engineering can make significant contributions by (*a*) performing the many tedious computations required faster and more accurately, and (*b*) opening up for practical use the analysis of highly complex nonlinear systems of mathematics. Specific applications to table-making computations and the solution of differential equations for a cycloidal crank-drive mechanism and a swing-type hammer mill, and summaries of the application to the machine design of large steam turbines and jet engines were given at a joint Machine Design Applied Mechanics session. As many as 70 different types of applications have been discovered for jet-engine design, and more are being added to the list.

Aviation. Methods of coping with weather conditions that cause jet-powered aircraft to take in large quantities of water, and a liquid-injection system to give a sudden increase in power and enable a B-47 bomber to take off from shorter runways were topics of one Aviation Division session. In joint session with IAS and SAE and with the Materials Handling Division, a panel outlined the latest thinking on the use of helicopters as flying cranes, indicating that larger helicopters capable of handling heavier loads in short-haul transport will be demanded. Feeders for domestic air-freight carriers will be small cargo-carrying planes, probably turboprop-powered and able to operate in and out of a 500-ft field over 50-ft obstacles and useful for distances ranging from 50 to 500 miles with a load capacity of 5 tons.

Wood Industries. Lamination, new types of mechanical fasteners, and "engineered timber construction" are giving new recognition to wood as a versatile material. Beams of almost unlimited size are available for structural framing of large buildings as a result of laminating techniques, and laminated beams are fire resistant and do not tend to deform during fire and collapse the side walls. New techniques in home building, including glued siding, prefabrication, and application of mass-production techniques may help to stop spiraling housing costs. Glued siding would substitute plywood-type panels as integral parts of the structure and add substantially to the strength of walls where bearing now depends completely on the two-by-fours.

Rubber and Plastics. Development of a chlorine-containing polyether plastic known as Penton, with a combination of outstanding properties for many applications where the use of plastics has been limited, was announced. The product now in the pilot-plant development stage by Hercules Powder Company can be molded into strain-free, close-tolerance,

R. E. Peterson, manager, Mechanics Dept., Westinghouse Research Labs, *left,* who presided at the International Conference on Fatigue of Metals; and D. G. Sopwith, director, Mechanical Engineering Research Laboratory, E. Kilbride, Scotland, the speaker, examine a copy of Professor A. M. Freudenthal's new book

ery, railways, and welding. R. B. Smith, Mem. ASME, M. W. Kellogg Company, was the honorary chairman, and J. F. Millan, Caterpillar Tractor, and C. J. Code, Pennsylvania Railroad, were the co-chairmen and reporters. An interesting point of discussion was the mention of the occurrence of fatigue cracks in building details.

The sixth session, with Prof. N. J. Hoff, Mem. ASME, Brooklyn Polytechnic Institue, as honorary chairman, A. B. Callender, Glenn L. Martin Company, as chairman, and P. Kuhn, National Advisory Committee for Aeronautics, as reporter, dealt with aircraft structures. This has turned out to be a problem of international interest. The latter part of this session was devoted to summarizing the discussion of the three-day meeting. The co-chairmen for the summary were Dr. Sopwith and Mr. Peterson.

The honorary chairmen, Dr. Sopwith, Dean Soderberg, Dr. Dryden, Major Teed, R. B. Smith, and Professor Hoff, added considerably to the meeting by emphasizing the important direction taken by each session. The committees that organized this conference deserve special credit. The British and European Committees were as follows: Organizing Committee, with S. F. Dorey as chairman, N. P. Allen, R. W. Bailey, M. L. Becker, D. G. Christopherson, H. L. Cox, Hugh Ford, H. J. Gough, K. Headlam-Morley, S. Livingston Smith, D. G. Sopwith, J. Taylor, P. Litherland Teed, Richard Weck, W. Ker Wilson; the Technical Committee, with D. G. Sopwith as chairman, N. P. Allen, M. L. Becker, H. H. Burton, H. L. Cox, H. J. Gough, J. McKeown, H. N. Pemberton, J. Taylor, P. Litherland Teed, and R. Weck. The North American Committee, with R. E. Peterson as chairman, is made up of: T. J. Dolan, A. M. Freudenthal, O. J. Horger, W. T. Lankford, B. J. Lazan, J. M. Lessells, and J. Marin.

The papers will appear in a bound volume, together with the discussions and the authors' closures. This is to be published by The Institution of Mechanical Engineers, and will be available about the middle of 1957. The price has not yet been determined. Sets of the preprints can be purchased from the ASME Order Department, 29 West 39th St., New York 18, N. Y., at $7.50 a set ($6 to ASME members).

Power Show and Inspection Trips

Power Show

Forecasts of an impending revolution in the mechanical world were strongly impressed on some 30,000 visitors to the 22nd National Exposition of Power and Mechanical Engineering in the New York Coliseum, Nov. 26–30, 1956. The exposition was held under the auspices of ASME and ran concurrently with the Annual Meeting.

Among the impressive displays in the well-rounded exhibition were models of planned atomic power stations. The most spectacular were those of guided missiles, heralding the impact of rocket enginery on commercial flight. The most significant were exhibits of materials, structures, and components that indicated the extent to which manufacturers of power-plant equipment and production machinery are not only spreading out into new fields, but also soaring to new and higher standards in conventional product design.

One aspect of the upsurge in research and development that the exposition forecast is the tremendous investment that is going into experimental and production facilities, all of which consume power and demand increased power production. This demand is rapidly being satisfied by the consumer industries themselves, and even more extensively by the public utilities.

A point of particular interest at the Power Show was the increased number of exhibitors in the line of engineering development. One of several such offers to the atomic-energy field a consulting service particularly designed to bridge the gap between science and engineering.

Another specializes in over-all project responsibility from systems studies through design and specification, procurement and installation, to contractual maintenance of measurement, control and data-handling systems, for an entire plant.

A number of remarkable new designs have been created to serve prosaic purposes—such as pumping—for the new industrial needs. A "coolant" pump to circulate liquid sodium and other molten metals at temperatures up to 1600 F and flow rates as high as 5000 gpm, was one of the developments which the exposition uncovered. Another was a coolant pump designed to circulate 18,300 gpm of water at 580 F. This is more than twice the temperature of boiling water.

As usual there was a large display of raw and fabricated materials. A manufacturer of copper tubing, illustrating the integrated billet-to-finished-tube production system, exhibited a drawbench at work on the final sizing step. A steel tube maker demonstrated a nondestructive quality-testing routine.

One of the innovations in metals was a new magnesium alloy for use under elevated-temperature conditions. It is available in sheet, plate, extrusions, and sand castings. High-resistance alloys in the ranges required to meet revolutionary designs were exhibited at another booth, along with a practical demonstration of ductile iron's remarkable properties.

A manufacturer responsible for noteworthy achievements in synthetic rubber products has developed plastic dies for new economy in shaping intricate parts for aircraft and automobiles. Now a new product has been added—solid propellant for rockets.

Aluminum tubes and tube sheets may replace admiralty metal in surface condensers and several other applications in steam, if joint studies by a producer of the metal, an equipment manufacturer, and several utility companies continue favorable, it was disclosed at one of the exhibits. Advantage would lie in cost saving plus the greater resistance of the aluminum alloys to ammonia, carbon dioxide, and hydrogen sulphide.

A substantial proportion of the exhibits were along the lines of power-plant equipment—piping, valves, instruments, and controlling devices; also auxiliary machinery, such as fans, blowers, pumps, air and water-filtration equipment, chemical feeders for water treatment, and many others.

metal parts, and are contributing to safe and economical operation by weeding out defective castings of such critical parts as couplers and wheel carriages.

Hydraulics. A review of the activities of the Committee on Water Hammer was given by the chairman, and it was noted that five of the six original members were still serving.

An accelerated test for measuring the intensity of the cavitation pitting rate in hydraulic equipment uses aluminum test plates fastened to hydraulic-turbine runners. The individual blows which constitute the hydrodynamic attack of cavitation on the guiding surface leave a record on this ductile material in the form of individual indentations or pits.

Management. Where a study of the activities of the average plant foreman revealed that only 25 to 30 per cent of his time was spent in direct supervision, almost 20 per cent to acting as messenger, 10 to 15 per cent to clerical, and 10 per cent to work with fellow supervisors, corrective measures were able to increase the time available for direct supervision to 40 or 50 per cent. The survey results were presented in a joint Management, Production Engineering, and Education Division session.

In a joint Safety and Management Division session, engineers were urged to take the lead in translating information from the biosciences on anatomical, physiological, and psychological problems into useful terms for engineering application. The new field of human engineering, born during World War II, is built upon the basic sciences of anthropometry, physiology, psychology, and related fields. The repeated demonstration of a quantitative relationship between external stress and human response which can be expressed in biophysical equations is of use in safety and management decisions.

There were, of course, many other papers on the program far too numerous to review in this limited space. A complete list of the available ASME papers presented at the Meeting may be found on pages 95 to 98 in this issue. In addition, digests of the numbered papers will be published in forthcoming issues of MECHANICAL ENGINEERING.

Fatigue of Metals Conference

More than 500 people attended the International Conference on Fatigue of Metals, held during the ASME Annual Meeting on November 28, 29, and 30, 1956. The papers of the conference had been presented in London, September 10–14, 1956, where 600 people discussed them. The conference was sponsored by The Institution of Mechanical Engineers with the co-operation of The American Society of Mechanical Engineers.

The task of presenting the information contained in 80 papers and in obtaining adequate discussion, and doing all this in three days, was a rather substantial undertaking made possible by using reporters. Each session had two reporters who divided the task of reporting and serving as chairman for the discussion. These men, all experts in the field, summarized groups of papers which they presented to the conference.

Dr. D. G. Sopwith, Mem. ASME, Mechanical Engineering Research Laboratories, as honorary chairman for the first session, opened the conference with a short welcome. He emphasized the industrial and engineering aspects of the subject. He then introduced Professor A. M. Freudenthal, Mem. ASME, Columbia University, and Prof. G. Sinclair, University of Illinois, the co-chairmen and reporters for Session 1. This session dealt with basic studies. The details of behavior as disclosed by optical and electron microscopes were discussed, together with the implications of modern physics theories dealing with dislocations, and so on.

Dean C. R. Soderberg, Fellow ASME, of the School of Engineering, Massachusetts Institute of Technology, was honorary chairman for the second session which dealt with stress concentration, combined stress tests, and the effect of mean stress. These subjects formed the basis of design and led to considerable discussion. The co-chairmen and reporters for this session were W. T. Lankford, Mem. ASME, U. S. Steel Research Laboratories, and D. G. Richards, Hamilton Standard Division of United Aircraft Corporation.

The third session, with H. L. Dryden, Fellow ASME, National Advisory Committee for Aeronautics, as honorary chairman, dealt with cumulative damage, statistical aspects, repeated strain cycling, and effect of frequency. These subjects were related to actual behavior of parts in service, i.e., airplane wings subjected to gust loading. Considerable differences in behavior have been obtained in cumulative damage tests carried out in different laboratories, and there was much discussion on this point, guided by E. H. Schuette, Dow Chemical Company, and Prof. T. J. Dolan, Mem. ASME, University of Illinois, the co-chairmen and reporters.

At the conference luncheon, held on Thursday, Mr. R. E. Peterson, Fellow ASME, Westinghouse Research Laboratories, presiding, read resolutions of appreciation for Dr. H. L. Gough, Dr. S. F. Dorey, and Prof. H. F. Moore. Retiring ASME President J. W. Barker read a letter of greetings from President T. A. Crowe, president of The Institution of Mechanical Engineers in London. Dr. Sopwith gave a delighful talk covering about fifty years of work on fatigue research as carried out at the National Physical Laboratories in Teddington, England, and the Mechanical Research Laboratories at East Kilbride, Scotland.

In the afternoon, the fourth session dealt with the effects of temperature, metallurgical aspects, light alloys, and corrosion. Major P. L. Teed, Vickers Armstrong, was the honorary chairman, and Prof. B. J. Lazan, University of Minnesota, Mem. ASME, and H. J. Grover, Battelle Memorial Institute, were the co-chairmen and reporters.

On Friday morning, the fifth session covered engineering and industrial significance of fatigue, general service, automobiles, aircraft engines, marine machin-

Group at the speaker's table of the International Conference on Fatigue of Metals Luncheon. *Left to right* are: R. B. Smith; J. M. Lessells; D. G. Sopwith, director, Mechanical Engineering Research Laboratory, E. Kilbride, Scotland, speaker; R. E. Peterson, who presided; Major P. Litherland Teed; ASME President Barker; and H. L. Dryden.

that of America's first atomic plant to go into regular operation. Its components already have been activated and the switch-throwing ceremony is scheduled for next March. One of the advantages of this type plant is that the components are transportable and can be placed in remote locations with comparatively little difficulty, whereas the conventional atomic plant requires extensive preplanning and construction work on the site.

Inspection Trips

On Monday afternoon, a group visited Chas. Pfizer & Company, Inc., in Brooklyn, N. Y. The tour included a visit to the biochemical and microbiological laboratories, where research is conducted on fermentation products, and antibiotics such as Terramycin and Tetracyn were discovered. Portions of the packaging units where modern and efficient packaging operations of pharmaceutical products are performed were seen. The chemical pilot plant and one of the unit process operations were also inspected.

The Astoria Plant, Consolidated Edison Company of New York, Inc., in Astoria, L. I., N. Y., a modern generating station with reheat pressurized boilers, was toured on Tuesday morning.

The Air Cargo Terminal Center at New York International Airport, Idlewild, L. I., N. Y., was visited on Tuesday afternoon. The Air Cargo Center is capable of simultaneous handling of 20 aircraft and 100 trucks. This is the largest and most modern air-cargo facility in the world, with 4 cargo buildings serving 27 airlines, and a two-story Cargo Service Building to house the federal inspection services, freight forwarders, customhouse brokers, bonded warehouse, and pickup and delivery cartage companies.

At the Ford Motor Company, Mahwah, N. J., on Wednesday morning, a group witnessed the cars being built from the frame through to the final stages. They also saw the testing of the cars including the roadability machine process.

A tour of all passenger facilities of the 30,000-ton American Export liner, *SS Constitution*, Pier 84 NR, was scheduled for Wednesday afternoon.

On Thursday morning, a group inspected the Port of New York Authority Lincoln Tunnel. They witnessed the 14 different phases of the third tube construction including tunnel segments, the invert, roadway, new lighting, newly installed signal system, and ventilation building.

A tour through the showroom and studios of Medallic Art Company, New York, N. Y., the only organization in the world devoted to the reproduction of medals, plaques, and tablets, was scheduled for Thursday afternoon. This company prepares all of the ASME awards, and some of the heaviest equipment on Manhattan is located at this plant. Of special interest were French die-reducing machines which reduce the sculptor's original model to medal size. Also special casting processes were of interest.

College Reunions and Committees

College Reunions

Seventeen colleges held reunions at luncheons, dinners, and meetings which had been planned to coincide with the Annual Meeting.

The alumni of the University of California met for luncheon at the White Turkey, where Dr. L. R. Fink of General Electric Research Laboratory spoke on "The Relation of Research to Engineering." The Carnegie Institute of Technology Alumni heard Dr. B. Richard Teare, Jr., Dean of the College of Engineering and Science, speak at the luncheon at the Architectural League of New York. The Mechanical Engineering Department of The Cooper Union Alumni held a reunion at The Cooper Union where the department laboratories were open for inspection. Director John O. Moore of the Cornell Medical College spoke on "Crash Injury Research" to the Cornell Society of Engineers at a dinner meeting. Georgia Institute of Technology held a dinner reunion at Reeves Sound Studios. The New York-Iowa State Alumni Association held a luncheon reunion at the Chemists' Club. Michigan State University of Agriculture and Applied Science met at the Washington Square Inn. There was a Missouri Engineers' Centennial Dinner at the Governor Clinton Hotel. The University of North Dakota held a reunion luncheon. Ohio State University College of Engineering met at a dinner to hear Dean Gordon B. Carson talk on "Engineering, 1957 Model—OSU," and to see Ohio State's movie, "Engineering for Eddie." Pratt Institute held a reunion dinner at Keen's English Chop House. Purdue University—1929 SPEE Summer School met at the Hotel Statler. Rensselaer Polytechnic Institute held a luncheon at the Hotel Statler. Stevens Institute of Technology held a reunion luncheon at the Stevens Metropolitan Club. The University of Texas met at the Governor Clinton Hotel. Worcester Polytechnic Institute Alumni Association held a meeting at Sacher's Restaurant in co-ordination with the ASME Power Show. The annual "Football Smoker" of the Yale Engineering Association was held at the Yale Club.

Committees in Charge

ASME meetings come under the general supervision of the Meetings Committee.

The technical program is provided by the Society's professional divisions and technical committees. Other features are planned and supervised by committees organized within the host section—in this case the Metropolitan Section. In grateful acknowledgment of the many committees whose efforts contributed so substantially to the success of the 1956 Annual Meeting their personnel is listed in what follows:

Meetings Committee: Jess H. Davis, *chairman;* Charles W. Parsons, Glenn R. Fryling, W. B. Wilkins, Arthur M. Gompf, H. Bernard Lindstrom, J. A. Sweeney, Jr.

Annual Banquet Committee: U. Amel Rothermel, *chairman;* Robert W. Cockrell, *vice-chairman;* John T. Jackman, Henry C. Wheaton, H. H. Johnson.

Plant Trips Committee: George J. Nicastro, *chairman;* James C. Costigan, Gordon C. Hahn, Arthur M. Perrin, James W. Wheeler.

Women's Events Committee: Mrs. William E. Karg, *honorary chairman;* Mrs. John C. Gibb, *general chairman;* Mrs. U. Amel Rothermel, *1st vice-chairman;* Mrs. William H. Byrne, *2nd vice-chairman.*

Metropolitan Section: G. R. Hahn, *chairman;* A. M. Perrin, *secretary;* H. H. Poor, *treasurer.*

Board on Honors: J. Stanley Morehouse, *chairman;* Harold C. R. Carlson, Robert M. Van Duzer, Jr., Eugene W. O'Brien, C. Richard Soderberg, H. Drake Harkins.

Medals Committee: J. Stanley Morehouse, *chairman;* Harold C. R. Carlson, Theodore H. Beard, Eugene Caldwell, Newton C. Ebaugh, Robert M. Van Duzer, Jr., Burnham Finney, Frank M. Gunby, Leon T. Mart, Eugene W. O'Brien, Wallace L. Chadwick, Hans Ernst, V. Weaver Smith, Alton C. Chick, Joseph W. Eshelman, C. Richard Soderberg, Julian B. Thomas, Martin Goland, William A. Hanley, H. Drake Harkins, George L. Sullivan.

Over-all view of one of the exhibit floors during the 1956 Power Show which was held at the New York Coliseum

This subcritical nuclear reactor, in actual operation, demonstrated by the Department of Physics, New York University, attracted many Power Show visitors

The Gulf Oil Corporation's exhibit created wide interest with its model of a free-piston engine—a possible future mode of power

Another large segment of exhibitors displayed electric motors and transmissions. This field is divided between motor manufacturers who, in part, produce geared power units for various applications, and manufacturers of transmissions who also offer motorized reduction gears. The result is an extensive selection of units, many of which have been designed to meet the specific needs of machine-tool drives. Examples were numerous also of belted variable-speed drives, and there was at least one all-metal speed variator.

Among the more significant aspects of the exposition was the evidence of continued growth in the market for package boilers, indicated both by the number of exhibitors in that line and their more extensive offerings. The array included several exceptional designs, such as the electric immersion-type boiler, which first appeared at the Power Show a number of years ago as a piece of laboratory equipment, but is now offered in a variety of portable and stationary applications; and a return-flow boiler with internally finned tubes, for accelerated heat transfer.

For applications requiring wide swings in steam demand, the smaller package units are often installed in batteries of several units, for step-by-step, on-off operation under full load. Automatic control simplifies this method of operation. A recent development in package boilers is the panelized control, permitting remote operation of the small steam plant.

An unusual development is the application of the package concept to a sizable coal/oil convertible boiler, which is capable of being broken down into several units for shipment and installation, but otherwise carries out the idea of the completely equipped and home-plant tested unit.

Measuring devices and control equipment for pressure, temperature, liquid flow, liquid level, and other applications were shown in the full range and variety characteristic of the exposition. One manufacturer's application of the module principle to the design and mounting of miniature instruments attracted attention by reason of its interchangeability. The system is adaptable to the control, regulation and data recording of an entire steam plant or processing sequence.

The comprehensive display of materials-handling equipment included, among other new presentations, a conveyer actuated by a revolving lead screw, which has unique advantages, and an inplant tractor with remote radio control which permits a single operator to handle the loading of an entire trailer train. A companion unit is an electronically controlled tractor that is steered, started, and stopped automatically by means of a tracking tape laid on the floor.

It was the consensus of visitors that the large number of scale models of power plants, reactors, and simulated plant equipment layouts were an outstanding feature of the exposition.

An especially noteworthy display was

Company will be used for the orientation seminar for ECPD inspectors that the the Committee plans to conduct during the coming year.

Sections. The affiliation contract between the Milwaukee Section and the Engineers Society of Milwaukee was approved. Section status was granted to the Northwest Florida Group; and the formation of the Winston-Salem Group of the Piedmont-Carolina Section was authorized.

Certificates of Award. Certificates of award were granted to various retiring chairmen of Sections and Subsections, to the past-chairman of the Milwaukee Section, Robert D. Teece (1954-1955), to retiring chairmen and members of the the executive committees of Professional Divisions; and to John M. Lessells, Hon. Mem. ASME, upon his retirement as Technical Editor of the *Journal of Applied Mechanics*, a post he has filled with distinction since 1935.

Deceased Members. The Council noted with deep regret the following deaths:

Lester D. Gardner, Nov. 23, 1956, organizer of the Institute of the Aeronautical Sciences.

Major General Charles H. Wesson, Nov. 24, 1956, Hon. Mem. ASME.

Arthur L. Williston, Nov. 16, 1956, a Member since 1896 and donor of the Arthur L. Williston Award.

1957 ASME Council Organized. The organization meeting of the 1957 Council, held on Monday evening, Nov. 26, 1956, at the Statler Hotel, was called to order by J. W. Barker, retiring President, who presented a gift, on behalf of members of the Council, to past-president Frederick S. Blackall, jr., in celebration of his 60th birthday. New and re-elected members of the Council were introduced and the gavel was then handed to William F. Ryan, President, who took the chair.

J. W. Barker Honored. The Council voted to extend to Joseph W. Barker, retiring President, deep appreciation and sincere thanks for his achievements during his administrative year in which he visited 26 Sections and 13 Student Sections, in addition to attending National Meetings, Professional Division Conferences, and other meetings of the Society and sister societies. Past-President D. W. R. Morgan presented the special President's Pin to Dr. Barker.

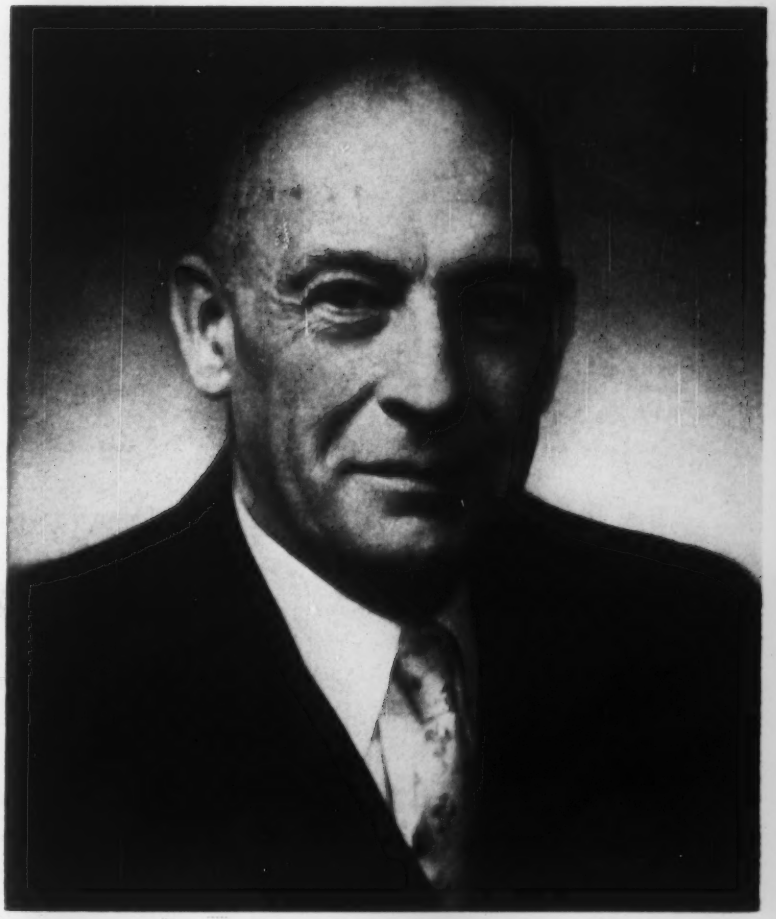
Appointments. The following appointments and re-appointments were voted:

C. E. Davies, Secretary of the Society

O. B. Schier, 2nd, Deputy Secretary of the Society

Thomas A. Marshall, Assistant Secretary

D. C. A. Bosworth, Assistant Secretary and Controller



Joseph Warren Barker

Retiring President of the American Society of Mechanical Engineers for 1956

Stanley A. Tucker, Assistant Secretary and Publication Business Manager

Joseph L. Kopf, Treasurer of the Society and of the Development Fund

Edgar J. Kates, Assistant Treasurer of the Society.

The foregoing appointments are for one year, ending Dec. 2, 1957.

Executive Committee. The personnel of the Executive Committee of the Council was appointed as follows: William F. Ryan, chairman, Frank L. Bradley, Charles E. Crede, Albert C. Pasini, and V. Weaver Smith.

Board and Committee Assignments. Assignments of Directors to the Boards and Committees are as follows:

Board on Codes and Standards: E. O. Bergman and Louis Polk

Board on Education and Professional Status: V. Weaver Smith

Board on Honors: H. C. R. Carlson

Board on Membership: H. C. R. Carlson

Board on Public Affairs: V. Weaver Smith

Board on Technology: G. A. Hawkins, E. W. Jacobson, R. B. Lea, and G. B. Warren

Finance Committee: Joseph Pope and D. W. R. Morgan (2-year term to replace H. R. Kessler)

Organization Committee: Frank L. Bradley (also C. B. Peck, re-appointed for 2-year term).

Committee on Staff Personnel. The Council Committee on Staff Personnel will be made up as follows:

F. S. Blackall, jr., chairman, F. L. Bradley, A. C. Pasini, W. H. Byrne, C. H. Shumaker, W. F. Ryan (President), and J. W. Barker (past-president, ex-officio).

Council Meetings

Actions of 1956 ASME Council

The 1956 Council of The American Society of Mechanical Engineers met in two sessions during the Annual Meeting of the Society at the Statler Hotel, New York, N. Y., the first on Saturday, Nov. 24, 1956, and the second on Monday, Nov. 26, 1956. President Barker presided.

At the Monday morning session the Secretary introduced the following members of his staff who had become associated with the Society during the year: L. S. Dennegar, director of public relations; Dean Freiday, editorial assistant; F. W. Hoernel, assistant divisions manager; William Laurie, advertising salesman; and John T. Reid, research manager.

Annual Reports. The annual report of the Council was adopted; and the reports of the Boards, Committees, and Representatives on Joint Activities were accepted as submitted. The annual and financial reports of the Woman's Auxiliary were received with an expression of sincere appreciation of the achievements during the years.

By-Laws and Rules. Several amendments to the By-Laws, which received first reading on June 16, 1956, and amendment to Article R4, Rule 1 (Qualifications for Admission) were adopted; and an amendment to Article B7, Pars. 4, 17, and 18 (Election of Officers and Directors) was presented for first reading. It was reported that the action of the Council on June 16, 1956, approving the change of designation of Student Branch to Student Section (identified by the name of the college) would involve changes in the Constitution, and hence the Council voted to confirm its policy that Student Branches should be designated Student Sections effective immediately, with the understanding that the Constitution, By-laws, and Rules will be amended accordingly when other Constitutional amendments are required.

Mechanical Engineering Subscription Rates. Upon recommendation of the Publications Committee, concurred in by the Board on Technology, the Council voted: (1) That subscription rates to MECHANICAL ENGINEERING for members be established at one half the nonmembers' subscription rates for the initial copy received as a part of members' dues; and (2) that additional subscriptions may be placed by members at the prevailing discount per members of 20 per cent less than the nonmember subscription rate. Subscription rates for certain classes of students not members of ASME Student Sections were referred to the Publications Committee for study.

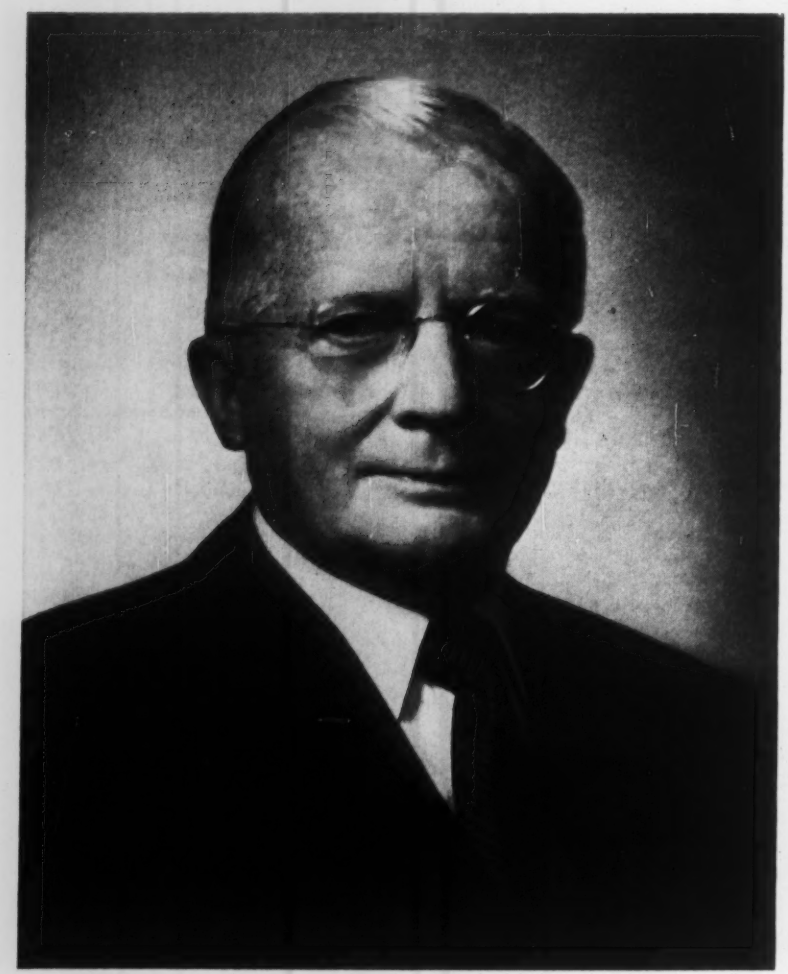
1958 Power Show. Authorization was granted of an agreement with the International Exposition Company relating to formal participation of ASME in the National Exposition of Power and Mechanical Engineering, New York, N. Y., Dec. 1, 1958.

Portrait of James Watt. It was reported that under authorization of the Executive Committee of the Council the Secretary has loaned to the Western Society of Engineers, on a permanent basis, one of the two portraits of James Watt belonging to ASME.

Engineers Joint Council. Approval was voted of the recommendation of Engineers Joint Council that the American Institute of Consulting Engineers be admitted to associated membership and the Society of American Military Engineers to constituent membership in EJC.

Engineers' Council for Professional Development. A change in the charter of Engineers' Council for Professional Development to permit admission of the National Society of Professional Engineers was approved.

Seminar for ECPD Inspectors. The Council authorized establishment of a Custodian Fund for the ASME Education Committee through which the contribution of $4000 from the General Electric



William Francis Ryan

President of The American Society of Mechanical Engineers for 1957

AVAILABILITY LIST FOR

1956 ASME Annual Meeting Papers

THE papers in this list are available in separate copy form until October 1, 1957. Please order only by paper number; otherwise the order will be returned. Copies of these papers may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y.

Paper No. — Title and Author

Air Pollution

56—A-198 CO Boiler Pays Off in Fuel Savings and Produces Zero CO, by N. E. Pennels

56—A-199 Experimental Investigation of Critical Design Factors for Vane-Type Cyclone Collectors, by A. B. Walker and W. H. Cole

Applied Mechanics

56—A-2 Structural Damping of a Simple Built-Up Beam With Riveted Joints in Bending, by T. H. H. Pian

56—A-3 The Synthesis of Four-Bar Mechanisms by the Method of Components, by J. Hirschhorn

56—A-4 The State Principle—Some General Aspects of the Relationships Among the Properties of Systems, by S. J. Kline and F. O. Koenig

56—A-5 Response of Beams and Plates to Random Loads, by A. C. Eringen

56—A-7 Yield Loads of Slabs With Reinforced Cutouts, by P. G. Hodge, Jr., and Nicholas Perrone

56—A-8 Head Loss in Flow Through a Cyclone Dust Separator or Vortex Chamber, by H. E. Weber and J. H. Keenan

56—A-9 Beams of Uniform Strength Subjected to Uniformly Distributed Loading, by W. A. Gross and J. P. Li

56—A-10 Dependence of the Frequency Spectrum of a Circular Disk on Poisson's Ratio, by R. L. Sharma

56—A-11 Experiments for the Determination of Transient Stress and Strain Distributions in Two-Dimensional Problems, by A. J. Durelli and W. F. Riley

56—A-13 A Simple Procedure for Improved Accuracy in the Resistor-Network Solution of Laplace's and Poisson's Equation, by H. G. Landau

56—A-14 A New Method for the Construction of Hencky-Prandtl Nets, by E. G. Thomsen

56—A-15 Some New Data on High-Speed Impact Phenomena, by J. H. Huth, J. S. Thompson, and M. E. Van Valkenburg

56—A-16 On the Stress Distribution at the Base of a Stationary Crack, by M. L. Williams

56—A-17 The Effect of a Circular Hole on the Pure Twist of an Infinite Strip, by Osamu Tamate

56—A-18 A Theoretical Analysis of the Viscous Flow in a Narrowly Spaced Radial Diffuser, by Henry W. Woolard

56—A-19 Velocity, Temperature, and Heat-Transfer Measurements in a Turbulent Boundary Layer Downstream of a Stepwise Discontinuity in Wall Temperature, by D. S. Johnson

56—A-20 Stresses and Displacements in an Elastic-Plastic Wedge, by P. M. Naghdi

56—A-21 A Theoretical Criterion for the Fracture of Metals Under Combined Alternating Stresses, by Takeo Yokobori

56—A-24 A Mixed Boundary-Value Problem of Elasticity With Parabolic Boundary, by Gunadhar Parta

56—A-25 Effect of Adverse Pressure Gradients on Turbulent Boundary Layers in Axisymmetric Conduits, by J. M. Robertson and J. W. Holl

56—A-26 Min-Max Solutions for the Linear Mass-Spring System, by Eugene Sevin

56—A-27 An Improvement of the Holzer Table Based on a Suggestion of Rayleigh's, by S. H. Crandall and W. G. Strang

56—A-28 Vibration Modes of Stators of Induction Motors, by E. Erdelyi and G. Horvay

56—A-29 Two-Dimensional, Steady, Cavity Flow About Slender Bodies in Channels of Finite Breadth, by Hirsh Cohen and Robert Gilbert

56—A-30 General Instability of a Ring-Stiffened, Circular Cylindrical Shell Under Hydrostatic Pressure, by S. R. Bodner

56—A-32 A New Method to Measure Prandtl Number and Thermal Conductivity of Fluids, by E. R. G. Eckert and T. F. Irvine, Jr.

56—A-33 A New Approach to the Theory of Thin, Slightly Cambered Profiles, by F. S. Weinig

56—A-34 Corrections for the Oscillating-Disk Viscometer, by J. Kestin and H. E. Wang

56—A-35 Forced Vibration of a Body on an Elastic Stratum, by G. B. Warburton

56—A-36 Buckling of Initially Imperfect Cylindrical Shells Subject to Torsion, by W. A. Nash

56—A-37 Longitudinal Impact of a Semi-Infinite Circular Elastic Bar, by Richard Skalak

56—A-38 A Numerical Procedure for Calculating the Large Deflections of Straight and Curved Beams, by A. E. Scames and H. D. Conway

56—A-49 Two-Dimensional Inflow Conditions for a Supersonic Compressor With Curved Blades, by Philip Levine

56—A-50 A Statistical Appraisal of the Prot Method for Determination of Fatigue Endurance Limit, by W. A. Hijab

56—A-51 Collapse Strength of Redundant Beams After Lateral Buckling, by E. F. Masur and K. P. Milbradt

56—A-52 A Theory of Adhesive Scarf Joints, by J. L. Lubkin

56—A-53 Dislocation Over a Bounded Plane Area in an Infinite Solid, by L. Rongved

56—A-54 Some Mixed Boundary-Value Problems of Semi-Infinite Strip, by G. Horvay and J. S. Born

56—A-55 Effect of Stress on Creep at High Temperatures, by H. Laks, C. D. Wiseman, O. D. Sherby, and J. E. Dorn

56—A-64 On Radial Deflections of a Cylinder Subjected to Equal and Opposite Concentrated Radial Loads, by S. W. Yuan and L. Ting

56—A-78 Point Source and Point Vortex in the Hodograph Plane, by H. Poritsky and R. A. Powell

Aviation

56—A-151 The Effect of Heavy Rainstorms on J47 Turbojet Operation, by S. S. Wayne

56—A-152 Experience With Water-Alcohol Injection on the J47 Engine, by M. K. Wolfson

56—A-160 Measurement and Integration of Acceleration in Inertial Navigation, by J. M. Slater

56—A-172 All-Cargo Aircraft Requirements for Efficient Ground Operation, by W. H. Arata, Jr.

56—A-173 Airfreight Sales Development, by T. J. Harris

56—A-174 Air Cargo Terminal Design and Location, by J. R. Wiley

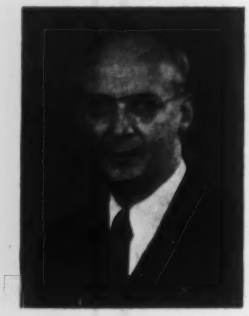
56—A-197 Materials Handling Equipment and Techniques for Loading and Unloading All-Cargo Aircraft, by C. W. Meldram

Fuels

56—A-184 Low-Temperature Deposits and Corrosion in Boilers, by J. R. Jenkinson

New Members of 1957 ASME Council

W. H. Byrne
Vice-President Region II



James H. Sams
Vice-President Region IV

Rolland S. Stover
Vice-President Region VI

C. H. Shumaker
Vice-President Region VIII

V. Weaver Smith
Administrative Director

E. W. Jacobson
Technical Director

Delegation of Functions to Boards. Certain functions were delegated to the Board on Technology and the Board on Codes and Standards.

Engineering Index. Extension of the contract with Engineering Index, Inc., with modification of compensation paid to the Society by the Index, was voted.

Business Meeting

1956 Annual Business Meeting

The Annual Business Meeting of The American Society of Mechanical Engineers was called to order by President Joseph W. Barker at 4:50 p.m., on Monday, Nov. 26, 1956, at the Hotel Statler, New York, N. Y.

C. E. Davies, secretary of the Society, presented the high lights of the Annual Report of the Council and of the Reports of the Boards, Committees, and ASME Representatives on Joint Bodies. H. J. Bauer, chairman of the Finance Committee, summarized the annual report of that Committee.

Mr. Bauer noted that the gross income of the Society for the fiscal year ending Sept. 30, 1956, was $2,166,354, the highest in the history of ASME. Expenses for the same period were $2,109,148, leaving a net income of $57,205.

During the year 1951–1952, Mr. Bauer pointed out, Society funds under control of the Finance Committee amounted to $1,299,457, the income from which was $31,191. In the period 1955–1956 Society funds totaled $1,677,542 and the income amounted to $63,390, an increase of 100 per cent in income with an increase of about 30 per cent in the total funds entrusted to the care of the Committee. Appreciation in the value of securities and increase in income resulted from investments in higher-income securities, retention of minimum-cash working balances, and the investment of temporary funds in Government notes of short duration, Mr. Bauer explained.

Mr. Bauer explained that the general policy under which the Finance Committee operated is outlined in the report of the Committee.

[The report of the Council and the report of the Finance Committee are printed in this issue. Copies may be obtained by request to the Secretary.]

The Secretary reported for the record names of 3391 members of various grades added to the membership since the 1955 Business Meeting and the names of 186 deceased members.

On a motion from the floor the acts and transactions of the Society and its Council during the year Oct. 1, 1955, to Sept. 30, 1956, were approved.

The Secretary then read the report of the Tellers for the election of officers, L. C. Morrow, A. R. Mumford, and R. W. Flynn, and the President called on each newly elected officer to stand. The officers elected are: Eugene W. Jacobson, and V. Weaver Smith, Directors; William H. Byrne (Region II, re-elected), James H. Sams (Region IV), Rolland S. Stover (Region VI), and Clifford H. Shumaker (Region VIII re-elected) vice-presidents; and William F. Ryan, President.

56—A-93 Standards for Filing Engineering Drawings, by L. Gerber

56—A-101 Responses of Temperature-Sensing-Element Analogs, by G. A. Coon

56—A-102 Method for Presenting the Response of Temperature-Measuring Systems, by Robert Looney

56—A-103 The Phase-Space Method for Analysis of Nonlinear Control Systems, by Y. H. Ku

56—A-104 Pressure-Flow Characteristics of Pneumatic Valves, by F. D. Ezekiel and J. L. Shearer

56—A-105 Design Basis for Cascade-Type Positional Servomechanisms, by Sidney Lees and T. C. Blaschke

56—A-149 Pilot Information Utilization—A Study in Human-Response Dynamics, by A. J. Cacioppo

56—A-158 (A) Dynamic Response of a Top Temperature Control System, by D. M. Boyd
(B) A New Maximum Power Criterion for Certain Hydraulic Control Valves, by R. P. Heintz
(C) Minimizing Undesirable Oscillations in Certain Two-State Electro-Hydraulic Control Valves, by R. P. Heintz
(D) Effect of an End Chamber on the Surge Frequency in a Hydraulic Conduit, by F. D. Ezekiel
(E) Frequency of a Preloaded System, by C. D. Pengelley
(F) A New Method for Analog Correlation, by J. B. Reswick
(G) Gearbox Layout (Logarithmic Spiral), by J. C. Sweeney

56—A-220 Diaphragm Characteristics, by Floyd B. Newell

Joint ASTM-ASME Committee

56—A-214 Chromium-Molybdenum and Chronium-Molybdenum Vanadium Steels for Power Plant and Refinery Service Up to 1100 F—An Appraisal of the Service, by G. V. Smith

Joint Research Committee

56—A-179 Use of the Bureau of Mines Condensate-Corrosion Tester for the Survey of Return-Line Deterioration, by A. A. Berk

56—A-191 Selecting Water-Treating Processes for Medium-Pressure Boilers, by S. B. Applebaum and R. J. Zumbrunnen

56—A-192 What Do Modern High-Pressure Boilers Demand of Feedwater? by P. F. Baggish

56—A-196 Conductivity Versus Sodium by Flame Spectrophotometer in Steam Purity Studies, by C. A. Bishof, J. Kenneth Brown, and H. Lewis Kahler

Machine Design

56—A-1 Effects of Complex Stress-Time Cycles on the Fatigue Properties of Metals, by W. L. Starkey and S. M. Marco

56—A-12 Impact Stresses in Drop Hammer Guides, by F. Koenigsberger and S. R. Ghabrial

56—A-48 Graphical Versus Computer Techniques for Mechanism Analysis, by L. F. Welanetz

56—A-67 A Nonintermittent Film Projector . . . Problems in Design and Manufacture, by O. Wittel and D. G. Haefele

56—A-73 Application of Digital Computers to Bearing Design, by B. Sternlieht and F. J. Maginniss

56—A-74 Fatigue of Metals Under Combinations of Stresses, by W. N. Findley

56—A-75 Vibration Design Charts, by J. N. Macduff and R. P. Felgar

56—A-98 Two Applications of a Digital Computer to Machine Design Problems, by J. T. Lester, Jr.

56—A-139 The Use of Digital Computers in the Mechanical Design of Large Steam Turbines, by E. E. Zwicky, Jr.

56—A-140 Characteristics of Unevenly Underlapped Four-Way Hydraulic Servo Valves, by Tsun-Ying Feng

56—A-142 The Use of High-Speed Computers in the Design and Appraisal of Helical Gears, by L. G. Johnson

56—A-143 Designing Jet Engines With a Medium-Size Digital Computer, by F. R. Heath

56—A-145 A Million-Pound High-Speed Dynamic Fatigue Test Machine, by Gregory Flynn, Jr., and A. F. Underwood

56—A-147 Accuracy Requirements of Graflex 70-mm Combat Camera Focusing System, by N. B. Seebe

56—A-162 Stress Distributions in Rotating Disks Subjected to Creep Including Effects of Variable Thickness and Temperature, by A. M. Wahl

Management

56—A-65 Engineering as a Function of Management, by J. E. Ritchey

56—A-76 Engineering—Tooled for Action, by J. E. Barbier

56—A-83 Mechanical Assembly Equipment, by G. R. Fitzgerald

56—A-84 First-Line Supervisors . . . How Do They Spend Their Time? by Jerome S. Underhill

56—A-96 Engineers Study Administration, by K. C. Harder

Materials Handling

56—A-114 Fork Truck Stability—A Study in Moments, by R. W. Puder, W. H. Bogar, and R. D. Jay

56—A-150 Materials Handling in Product Finishing, by J. C. Somers

56—A-193 Materials Handling of Bulk Materials in the Meat-Packing Industry, by Paul Speer

Mechanical Pressure Elements

56—A-221 Some Suggestions for Research in Diaphragm Technology, by F. H. Lyon and H. J. Grover

Metal Processing

56—A-6 An Experimental Study on Chatter Vibrations in Grinding Operations, by S. Doi

56—A-43 On the Basic Mechanics of the Grinding Process, by W. R. Backer and M. E. Merchant

56—A-44 Influence of Various Grinding Conditions Upon Residual Stresses in Titanium, by P. A. Clorite and E. C. Reed

56—A-45 Experimental and Theoretical Pressures and Velocity Fields for Various Lead Extrusions, by E. G. Thomsen and J. Frisch

56—A-86 On the Theoretical Analysis of a Dynamic Thermocouple, by E. W. Gaylord, W. F. Hughes, F. C. Appl, and F. F. Ling

56—A-87 Temperature Distribution at Tool-Chip and Tool-Work-Interface in Metal Cutting, by B. T. Chao and K. J. Trigger

56—A-88 Cold Extrusion of Unalloyed Titanium, by A. M. Sabroff, O. J. Huber, and P. D. Frost

56—A-89 Transient Interface Temperatures in Plain Peripheral Milling, by D. E. McFeron and B. T. Chao

56—A-90 A Tool-Work-Thermocouple Compensating Circuit, by K. J. Trigger, R. K. Campbell, and B. T. Chao

56—A-154 Shear-Strain Rate in Metal Cutting and Its Effects on Shear Flow Stress, by D. Kececioglu

56—A-155 Force Components, Chip Geometry, and Specific Cutting Energy in Orthogonal and Oblique Machining of SAE 1015 Steel, by D. Kececioglu

Metals Engineering

56—A-39 Nonhomogeneous Yielding of Steel Cylinders I—Mild Steel, by M. C. Steele and L. C. Eichberger

56—A-40 Creep Characteristics of Type 347 Stainless Steel at 1050 and 1100 F in Tension and Compression, by M. J. Manjoine

56—A-107 Effects of Neutron Radiation Upon the Tensile and Impact Properties of ASTM-A-302-B Steel, by E. E. Baldwin

56—A-108 Delayed-Yield Time Effects in Mild Steel Under Oscillatory Axial Loads, by R. O. Belsheim

56—A-109 Influence of Repeated Bending Loads on Biaxial Residual Stresses in Shot-Peened Plates, by T. M. Elsesser

56—A-110 The Flow and Fracture of Nodular Cast Iron, by W. R. Clough and M. E. Shank

Nuclear Engineering

56—A-166 The Yankee Atomic Electric Plant, by Glenn A. Reed, Robert J. Creagan, and Walter C. Woodman

56—A-167 The Consolidated Edison Indian Point Nuclear Power Plant, by G. R. Milne and F. R. Ward

56—A-189 Competition, Substitution, and Demand Among Fuels, by P. W. McGann

56—A-211 Evaluating Coal by Utilization Cost, by W. H. Attwill, C. E. Day, Jr., and A. J. Johnson

56—A-212 Discussion of Dust Suppression in Coal Handling, by I. M. Fisher

Furnace Performance Factors

56—A-159 The Formation of Sulphuric Acid in Boiler Flue Gases, by W. F. Harlow

56—A-161 In-Service Washing of Ljungstrom Air Preheaters on Pulverized Coal-Fired Steam Generators, by H. J. Hupfer, R. J. Stanley, and A. H. Van Sickle

Gas-Turbine Power

56—A-23 Free-Piston Engines and Compressors, by J. A. Scanlan and B. H. Jennings

56—A-202 Practical Solution of Plastic Deformation Problems in the Elastic-Plastic Range, by A. Mendelson and S. S. Manson

56—A-203 The Evolution of a Small Turbojet, by A. T. Gregory and J. A. King

56—A-204 A New Concept in Engine Gas-Generator-Turbine Plant, by R. P. Ramsey and S. L. Soo

56—A-205 Measurements of Relative Flow Distributions in Mixed-Flow Impellers, by J. E. Ash

56—A-206 Recovery Ratio—A Measure of the Loss Recovery Potential of Compressor Stages, by L. H. Smith, Jr.

56—A-207 Air and Gas Duct System for the Gas-Turbine Vessel John Sergeant, by W. A. Sherbrooke and H. Monroe, Jr.

56—A-208 Pressure Drop and Air-Flow Distribution in Gas-Turbine Combustors, by J. S. Grobman and R. T. Dittrich

56—A-209 French Experience With Free-Piston Gasifiers, by N. Barthalon and H. Horgen

56—A-210 A 40-Foot Personnel Boat With Gas-Turbine Propulsion—Engine Installation Features and Operating Experience, by P. G. Carlson, A. C. Ridland, and D. E. Blackwood

56—A-213 Aerodynamic Design of Vaned Diffusers for Centrifugal Compressors, by C. R. Faulders

Heat-Conduction Charts

56—A-118 Rate of Temperature Change of Simple Shapes, by Victor Paschkis and J. W. Hlinka

Heat Transfer

56—A-42 A Theoretical Analysis of Heat Transfer in Natural Convection and in Boiling, by Yan Po Chang

56—A-62 Heat Transfer to Lead-Bismuth in Turbulent Flow in an Annulus, by R. A. Seban and D. F. Casey

56—A-69 The Effect of Condensate Reheat on Mean Temperature Difference in Feedwater Heater Subcooling Zones, by Karl A. Gardner

56—A-70 Transient Air Temperatures in a Duct, by S. E. Rea and C. M. Ablow

56—A-71 Heat Transfer From a Rotating Cylinder With and Without Cross Flow, by W. M. Kays and I. S. Bjorklund

56—A-72 The Viscosity of Five Gases: A Re-Evaluation, by J. Kestin and H. E. Wang

56—A-91 Transient Heat-Flow Determination of the Thermal Properties of Clay, by E. B. Penrod and G. T. Privon

56—A-106 Design of Supersonic Expansion Nozzles and Calculation of Isentropic Exponent for Chemically Reacting Gases, by R. Edse

56—A-111 Heat Transfer by Radiation From Flames, by R. A. Sherman

56—A-112 New Finite-Difference Technique for Solution of the Heat-Conduction Equation, Especially Near Surfaces With Convective Heat Transfer, by H. G. Elrod, Jr.

56—A-113 Experimental Studies of Free-Convection Heat Transfer in a Vertical Tube With Uniform Wall Heat Flux, by J. P. Hartnett and W. E. Welsh

56—A-115 Sublimation From Disks to Air Streams Flowing Normal to Their Surfaces, by H. H. Sogin

56—A-123 Shell-Side Characteristics of Shell-and-Tube Heat Exchangers. A Simplified Rating System for Commercial Heat Exchangers, by Townsend Tinker

56—A-124 Heat-Transfer and Flow-Friction Characteristics of Woven-Screen and Crossed-Rod Matrices, by L. S. Tong and A. L. London

56—A-125 Heat Transfer to Laminar Boundary Layers With Variable Free-Stream Velocity, by R. A. Seban

56—A-126 Convection Heat Transfer and Pressure Drop of Air Flowing Across In-Line Tube Banks, Part I—Apparatus, Procedures, and Special Effects, by C. E. Jones and E. S. Monroe, Jr.

56—A-127 Convection Heat Transfer and Pressure Drop of Air Flowing Across In-Line Tube Banks, Part II—Correlation of Data for Ten-Row Deep Tube Banks, by A. J. Gram, Jr., C. O. Mackey, and E. S. Monroe, Jr.

56—A-128 Heat-Transfer Characteristics of the Rotational and Axial Flow Between Concentric Cylinders, by Carl Gazley, Jr.

56—A-129 The Determination of the Equation of State From Wave-Front Observations, by E. F. Lype

56—A-130 Estimation of Temperature Patterns in Multiply Shielded Systems, by J. G. Bartas and E. Mayer

56—A-133 Heat Transfer and Fluid Friction During Flow Across Banks of Tubes—V1, by O. P. Bergelin, K. J. Bell, and M. D. Leighton

56—A-135 Effects of Junction Manufacture on Thermocouple EMF Generation, by Erich A. Farber and M. R. Glickstein

56—A-144 Compilation of Radiation Shape Factors for Cylindrical Assemblies, by H. Leuenberger and R. A. Person

56—A-146 Heat Transfer From a Rotating Disk in Turbulent Flow, by F. Kreith and J. H. Taylor, Jr.

Hydraulic

56—A-41 An Experimental Study of Centrifugal-Pump Impellers, by A. J. Acosta and R. D. Bowerman

56—A-47 Investigation of the Interaction of Windage and Leakage Phenomena in a Centrifugal Compressor, by Hisao Jimbo

56—A-57 Accelerated Field Tests of Cavitation Intensity, by R. T. Knapp

56—A-58 Jet-Pump Theory and Performance With Fluids of High Viscosity, by R. G. Cunningham

56—A-63 Losses in Pipe and Fittings, by R. J. S. Pigott

56—A-85 Progress Report on Standardization of the Vibratory-Cavitation Test, by L. E. Robinson, B. A. Holmes, and W. C. Leith

56—A-120 Computer Representations of Engineering Systems Involving Fluid Transients, by F. D. Ezekiel and H. M. Paynter

56—A-121 Compensation of Steady-State Flow Forces in Spool-Type Hydraulic Valves, by R. N. Clark

56—A-122 Equivalent Performance Parameters for Turboblowers and Compressors, by Hunt Davis

56—A-131 Skewed Boundary-Layer Flow Near the End Walls of a Compressor Cascade, by R. W. Moore, Jr., and D. L. Richardson

56—A-132 An Investigation of the End-Wall Boundary Layer of a Turbine-Nozzle Cascade, by J. R. Turner

56—A-134 Pressure Drop for Parallel Flow Through Rod Bundles, by B. W. LeTourneau, R. E. Grimble, and J. E. Zerbe

56—A-148 The Effects of Back Pressure on Hydraulic Oil-Control Valves, by J. J. Pippenger

56—A-153 An Automatic Spray Desuperheating, Closed System for Testing Compressors, by C. A. Macaluso

56—A-190 Resistance Coefficients for Laminar and Turbulent Flow Through One-Half Inch Valves and Fittings, by C. P. Kittridge and D. S. Rowley

Instruments and Regulators

56—A-92 Signal Stabilization of a Control System, by R. Oldenburger

Reviews of Books

And Notes on Books Received in Engineering Societies Library

Nomograms

ABACS OR NOMOGRAMS. By A. Giet. Translated and revised by J. W. Head and H. E. Phippen. Philosophical Library, Inc., New York, N. Y., and Iliffe & Sons, Ltd., London, England, 1956. Cloth, $5^1/_2 \times 8^1/_2$ in., appendixes, examples, diagrams, scales, figs., charts, ix and 225 pp. $12.

Reviewed by Douglas P. Adams[1]

THE term "nomogram" properly applies not only to alignment diagrams but also to what Americans call network charts. The author has used the term in this broad, inclusive sense. In presenting alignment diagrams, authors either include or exclude the use of determinants—this author excludes them. Such exclusion usually means that the workings of the various types of alignment diagram are explained by means of Euclidean geometry and trigonometry. The author uses both these fields and also the analytic tool of parallel (line) coordinates, the latter being a somewhat unusual feature of the book. The use of line co-ordinates permits the duality of point and line in network chart and alignment diagram, respectively, to be referred to briefly but it introduces one further hurdle of complexity not easily cleared by the average American beginner. A second unusual feature is the extensive use of parallel and perpendicular index lines in compound charts.

This book is arranged in normal and logical order; diagrams, scales, simple and compound charts, alignment diagrams of up to four variables, compound diagrams for more than four variables, and so on. These subjects are treated at conventional length but with a thoroughness and care that is nice to see. For instance, some books give a graphical method for producing a projective scale which is at best an approximation. Professor Giet calls it a Homographic scale (his only long word), but he gives a sound method for deriving the center of projection. This method is followed by a careful section entitled "Justification of the Graphical Construction of a Homographic Scale" and this section by an equally careful "Note" in which it is observed that this graphical method is seldom as accurate as computed results.

The book gets across its message well. One reason for this is the general practice just observed of presenting first the basic principle of a section, followed by whatever rules appropriately obtain, and supported by notes which abbreviate procedures or amplify or qualify them sensibly.

A great many problems are solved to illustrate the theory. These have an attraction of their own because they are sensible and well adapted to their purpose. The diagrams also are well prepared, legible, and professional in appearance. Figure 108 is one of few exceptions in being hard to read in detail. There has been no discussion of dependent and independent variable—that is, of the importance of knowing, and methods of using, the variable which is thought of as the answer variable. This is a worthwhile topic because it often determines how the area available for a diagram can be best used to place the scales in enlarged and strategic positions.

The 6 × 8-in. format is handy in size and still requires only 225 pages of text. The book is beautifully printed, easy on the eyes in reading. The translation and editing are crisp and smooth. The term "ABAC" will be quite a mouthful to the average American, serves little purpose, but is the only truly prickly morsel of this kind.

It would have been nice to have had an index for a book as good as this. Some tabulation of the problems and formulas solved and diagrams drawn would also have been useful because readers frequently remember propositions in a book by the problems they happen to have been associated with and refer back to them this way.

In spite of its many good qualities, a price of $12 seems high.

[1] Associate Professor of Engineering Graphics, Massachusetts Institute of Technology, Cambridge, Mass.

Library Services

ENGINEERING Societies Library books may be borrowed by mail by ASME Members for a small handling charge. The Library also prepares bibliographies, maintains search and photostat services, and can provide microfilm copies of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th St., New York 18, N. Y.

Books Received in Library

AERODYNAMICS PROPULSION STRUCTURES AND DESIGN PRACTICE. By E. A. Bonney, M. J. Zucrow and C. W. Besserer. 1956, D. Van Nostrand Company, Inc., Princeton, N. J. 595 p., $6 \times 9^1/_4$ in., bound. $10. The series "Principles of Guided Missiles Design," of which this is the second volume, is intended to provide engineers and graduate students with basic information on missile technology. The present volume consists of three sections. Section 1, on general supersonic aerodynamics, deals with such problems as skin friction, shock waves, and loads, and contains material on wind tunnels, ballistic ranges, and flight testing. Section 2 discusses the thermodynamic and aerodynamic principles governing the operating characteristics of jet propulsion engines. Section 3 covers the design of the airframe and the packaging of its contents. Each section includes a bibliography.

THE AEROTHERMOPRESSOR. By Ascher H. Shapiro. 1956, The University of Nottingham, Departments of Civil and Mechanical Engineering, Nottingham, England. Various paging, $8^1/_2 \times 10^9/_8$ in., bound. 63s. The first lecture in this series of five lectures is a survey of the principles of one-dimensional gas dynamics necessary for an understanding of the aerothermopressor, a device for atomizing water into a high-speed, hot stream of air, with the objective of realizing the rise in stagnation pressure which is theoretically possible. The second and third lectures are summaries of the theoretical and experimental work done on the device. The last two lectures deal with a deceleration probe for measuring properties of a droplet-laden gas stream and with evaporation of a cloud of particles of nonuniform size.

AIRCRAFT MATERIALS AND PROCESSES. By George F. Titterton. Fifth Edition, 1956. Pitman Publishing Corporation, New York, N. Y. 398 p., $6 \times 9^1/_4$ in., bound. $6. This is a compilation, for engineers and designers, of essential information on metals, wood,

56—A-168 Enrico Fermi Atomic Power Plant, by John F. Anderson, Weymouth N. McDaniel, and Charles M. Heidel

56—A-169 The Dresden Nuclear Power Station, by J. R. Walcott, V. A. Elliott, E. P. Peabody, G. M. Roy, J. L. Schanz, and G. Seger

56—A-170 The P. A. R. Homogeneous Reactor Project, by W. E. Johnson, D. H. Fax, and S. C. Townsend

56—A-171 Proposed 75,000-kw Sodium Graphite Reactor for the Consumers Public Power District of Nebraska, by F. C. Gronemeyer

Oil and Gas Power

56—A-99 The Development of a Supercharged Medium-Speed Two-Cycle Opposed Piston Engine, by A. K. Antonsen

56—A-100 Design and Development of a Two-Cycle Turbocharged Diesel Engine, by P. J. Louzecky

56—A-138 Torque Converters—A Flexible Drive, by H. L. Wilke

56—A-140 Future Developments of the High-Speed Diesel Engine, by E. Chatterton

Petroleum

56—A-31 Apparent Frictional Forces on Clamping Elements as Used in the Oil Industry, by E. J. Moser and J. C. Wilhoit, Jr.

56—A-60 Concurrent Flow of Air, Gas-Oil, and Water in a Horizontal Pipe, by D. P. Sobocinski and R. L. Huntington

56—A-61 The Application of Gas/Liquid Cyclones in Oil Refining, by J. R. J. Van Dongen and A. J. Ter Linden

56—A-97 Yesterday, Today, and Tomorrow—Pipeline Steels, by A. B. Wilder and A. F. Aebersold

Power

56—A-116 A Method for Calculating Vibration Frequency and Stress of a Banded Group of Turbine Buckets, by M. A. Prohl

56—A-117 Experimental Determination of Gear-Tooth Stresses in Large Marine Gears, by H. W. Semar and R. E. McGinnis

56—A-119 High-Frequency Vibration of Steam-Turbine Buckets, by F. L. Weaver and M. A. Prohl

56—A-156 The Eddystone Superpressure Unit, by C. B. Campbell, C. C. Franck, Sr., and J. C. Spahr

56—A-157 Metallurgical Considerations of Main Steam Piping for High-Temperature, High-Pressure Service, by H. S. Blumberg

56—A-164 Engineering the Eddystone Steam Generator for 5000-Psig, 1200-F Steam, by E. M. Powell.

56—A-165 Engineering the Eddystone Plant For 5000-Lb 1200-Deg Steam, by J. H. Harlow

56—A-177 Importance of Matching Steam Temperatures With Metal Temperatures During Starting of Large Steam Turbines, by R. L. Jackson, S. B. Coulter, and R. Sheppard

56—A-178 An Investigation of Thermal Stress Fatigue as Related to High-Temperature Piping Flexibility, by L. F. Coffin, Jr.

56—A-181 Eight Years of Experience With Austenitic-Steel Piping Materials at Elevated Steam Conditions, by F. P. Fairchild

56—A-185 Are Standards or Codes Practical for Ultrasonic Examinations of Metals and Weldments? by F. C. Parker

56—A-215 A New Type Automatic Dispatching System at Kansas City, by D. H. Cameron and E. L. Mueller

56—A-216 Boiler Vibration Caused by Combustion Gas Flow, by John Halliday

56—A-217 Austenitic Steel in High-Temperature Steam Piping, by R. M. Curran and A. W. Rankin

56—A-219 The Information Center With Automatic Logger and Scanner—Neches Power Station, Gulf States Utilities Company, by J. A. Reich and W. B. Gurney

56—A-222 Evaporated Makeup Water for a Monotube Boiler, by R. F. Andres

Power Test Codes Committee

56—A-22 Instrumenting a Field Study of Industrial Water-Cooling Tower Performance, by J. L. Willa and Technical Subcommittee No. 2 of the Cooling Tower Institute

56—A-59 Cooling Towers for Steam-Electric Stations—Selection and Performance Experiences, by M. W. Larinoff

Process Industries

56—A-186 Spray-Dryer Design Calculations, by M. Doumas and A. Huste

56—A-187 Analysis of a Process-Fluid-Flow Network by Electrical Analogy, by C. F. Kayan and J. A. Balmford

Production Engineering

56—A-77 Ultrafinishing—A New High-Precision Lapping Process, by T. G. Lewis, Jr.

56—A-94 Shell Castings—Typical Examples of Their Applications, by H. G. Sieggreen

56—A-95 Fabrication of Vulcanized Fiber, by J. Macadam

56—A-218 Ceramic and Carbide Tool Performance Tests—Part I, by A. O. Shmidt, I. Ham, W. I. Phillips, and G. F. Wilson

Railroad

56—A-66 Air Brakes for High-Speed Ultra-Lightweight Passenger Trains, by T. H. Bickerstaff

56—A-68 Dual-Powered High-Speed Locomotive, by Robert Aldag and F. L. Sahlmann

56—A-79 A Progress Report on Development of an Atomic-Powered Locomotive, by B. C. Gunnell

56—A-80 The Effect of Improved Draft Gears and Spring Dampened Trucks on Freight-Car Shocks, by H. W. Faus

56—A-81 The Use of Atomic Energy in the Testing of Materials, by W. M. Keller

56—A-82 Trailers in Piggy-Back Operation From a Manufacturer's Point of View, by J. J. Black

56—A-194 Progress in Railway Mechanical Engineering—1955-1956, by D. R. Meier

Rubber and Plastics

56—A-163 Electrical Effects Accompanying the Stick-Slip Phenomenon in Boundary Lubrication, by S. M. Skinner, J. Gaynor, and G. M. Sohl

56—A-175 Polymer Properties Involved in Process Equipment Design, by H. J. Karam

56—A-176 Roll Bending Applied to Rubber and Plastic Calenders, by R. C. Seanor

56—A-182 Penton—A New Chlorine-Containing Polyether, by E. W. Cronin

56—A-183 A Review of Developments in Plastics Engineering—1955-1956, by Bryce Maxwell

56—A-195 High-Horsepower Banbury Mixing, by R. N. Comes

56—A-201 The Fundamental Mechanics of Reinforced Plastics, by J. Ogden Outwater, Jr.

Safety

56—A-46 The Human Factor in Machine Design, by T. F. Hatch

56—A-56 Toxicity of Materials of Interest to the Mechanical Engineer, by J. B. Skinner

56—A-188 Safety Standards, by Cyril Ainsworth.

Wood Industries

56—A-136 Recent Developments in Engineered Timber Construction, by J. C. VanDyke

56—A-137 Fire Safety of Engineered Timber Construction, by F. J. Hanrahan

56—A-180 The Design of Timber Roof Truss With Nail-Glued Connections, by B. M. Radcliffe

Roundup

Of Current Engineering Events, News, and Comment

E. S. Newman, *News Editor*

Left to right: **Ralph Budd, Hon. Mem. ASME; Harlow H. Curtice; and Carlton S. Proctor, president of AICE, at annual dinner of American Institute of Consulting Engineers, Waldorf-Astoria, Nov. 27, 1956. Mr. Budd received AICE Award of Merit. Mr. Curtice was principal speaker.**

H. H. Curtice Lauds Technology at AICE Annual Dinner in New York

Ralph Budd, Hon. Mem. ASME, Receives AICE Award of Merit

"Technical progress is our key to economic progress—to a higher standard of living and a better way of life. It is also the key to a strong national defense," said H. H. Curtice at the annual dinner of the American Institute of Consulting Engineers, held in New York, N. Y., Nov. 29, 1956.

Mr. Curtice, president of General Motors, was the principal dinner speaker. The occasion was marked also by the presentation of the AICE Award of Merit to Ralph Budd, Hon. Mem. ASME, retired chairman of the Chicago Transit Authority. Mr. Budd formerly was president of the Great Northern Railway and the Burlington-Rock Island Railroad. Mr. Curtice was introduced by C. F. Kettering, director and research consultant to General Motors.

Advances in technology are not automatic, Mr. Curtice stated, they vary importantly from year to year. There is no such thing, he added, as "guaranteed annual progress."

Mr. Curtice credited the desire of every American for technological advancements to improve his own standard of living. Another requirement for technological progress is adequate capital.

Continued technological progress also requires another ingredient, which Mr. Curtice called "the attitude of the inquiring mind."

"This attitude of mind is never satisfied with things as they are," he said. "It assumes that anything and everything can be improved. It recognizes the inevitability of change. It is always seeking better ways to make things and better things to make."

"Ralph Budd had an inquiring mind," said Mr. Curtice to illustrate how an inquiring mind with a light-weight train concept led to a revolution in American railroading through the dieselization of rail transportation which until the Nineteen Thirties had depended almost entirely on steam.

As a matter of fact it took two inquiring minds, the other was Charles F. Kettering, Fellow ASME, who was at that time working on diesel developments. In February, 1934, the Pioneer Zephyr was completed—a revolutionary new concept in rail transportation that represented a tremendous advance in technology.

In conclusion Mr. Curtice said, "We need more such strides forward in our technology. We need more right in the broad area of transportation. We need more Ralph Budds to spark them."

Ralph Budd was then introduced by Alfred E. Perlman, president, New York Central Railroad, for the presentation of the Award of Merit.

Carlton S. Proctor, president of AICE, presided.

A footnote to success was contained in Mr. Budd's acceptance remarks. He remarked that Mr. Kettering said he would choose Alfred E. Sloan as a boss; Mr. Perlman asked for a brilliant leader to follow; Mr. Budd asked for a job in a good company that he could turn into a greater company!

Meetings of Other Societies

Jan. 16–18
Society of Plastics Engineers, 13th annual national technical conference, Sheraton-Jefferson Hotel, St. Louis, Mo.

Jan. 21–25
American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York, N. Y.

Jan. 28–31
Plant Maintenance and Engineering Show, Public Auditorium, Cleveland, Ohio

Feb. 4–8
American Society for Testing Materials, Committee Week, Benjamin Franklin Hotel, Philadelphia, Pa.

(For ASME Coming Events, see page 115)

plastics, rubber, and other materials, and on heat treating, surface hardening, joining, forming, and other processes. Numerous suggestions are included on the choice of materials or processes for specific applications. Emphasis has been placed, in this edition, on the effects on materials of heat from aerodynamic heating and jet engines, and changes have been made throughout the text in order to take into account recent advances.

ANALOG COMPUTER TECHNIQUES. By Clarence L. Johnson. 1956, McGraw-Hill Book Company, Inc., New York, N. Y. 264 p., 6 × 9¼ in., bound. $6. It is the purpose of this book to provide students with the information necessary for the competent operation of the electronic differential analyzer, and to demonstrate to engineers the capabilities and limitations of this type of computer. The early chapters discuss linear components; amplitude and time-scale factor adjustment; the set up of linear systems of differential equations; nonlinear components; and function-generating techniques. The later chapters consider such topics as applications to the solution of problems other than ordinary differential equations, checking results, and repetitive analog computers.

ASTM STANDARDS ON RUBBER PRODUCTS (1956). Published annually by the American Society for Testing Materials, Philadelphia, Penna. 741 p., 6 × 9 in., paper. $5.75. Compiled into a single volume for convenience of reference, these standards cover processibility, aging, weathering, and low-temperature tests; physical and chemical tests for vulcanized rubber, and specifications and methods of tests for such products as automotive and electrical rubber, electrical protective equipment, insulated wire and cable, and non-rigid plastics. Various standards for latex, latex foam, sponge rubber, and rubber adhesives are also included.

AUTOMATIC DIGITAL COMPUTERS. By M. V. Wilkes. 1956, John Wiley and Sons, Inc., New York, N. Y. 305 p., 5½ × 8¼ in., bound. $7. Emphasizing general principles, this book covers design, principles of programming, relay computers, storage, switching circuits, and computing circuits. An introductory chapter surveys the development of computers from Babbage to EDVAC, and the last chapter deals with special problems of design and operation, the organization of a computer center, and applications in business and industrial processes. A detailed description of EDSAC and brief descriptions of other computers are included.

CHAMBERS D'ÉQUILIBRE. By André Gardel. 1956, F. Rouge & Cie., Lausanne, Switzerland. 158 p., 6⅜ × 9¼ in., paper. Sw. Frs. 24.85. Part 1 of this mathematical treatment of hydroelectric plant surge tanks analyzes the effect of various conditions such as the dimensions of the upstream reservoir, the angle of the surge tank riser, etc. In part 2 a method of rapid calculations is developed based on "relative values," expressing by a few parameters the co-ordinated variables of similar systems. The graphical as well as the analytical representation of the method is given.

COMMUNICATION ENGINEERING. By W. L. Everitt and G. E. Anner. Third Edition, 1956. McGraw-Hill Book Company, Inc., New York, N. Y. 644 p., 6 × 9¼ in., bound. $9. The third edition of this standard work concentrates on the fundamentals of linear-network analysis, including the use of unilateral elements. The opening chapters are devoted to general principles and methods of analysis, the later chapters to such topics as resonance, wave filters, reflection, lines of low loss, impedance transformation, impedance matching, equilization, linear amplifiers, and electromechanical coupling.

CONTRACTS, SPECIFICATIONS AND ENGINEERING RELATIONS. By D. W. Mead. Third edition, 1956, rewritten by Mead and Hunt, Inc., with J. R. Ackerman. McGraw-Hill Book Company, New York, N. Y. 427 p., 6 × 9¼ in., bound. $7. The first part of this standard text deals with the training and work of the engineer, factors determining professional success, engineering ethics, and the writing of letters and reports. The second part deals, briefly, with the engineer in various legal situations, (as an agent, as an expert witness, etc.), and, in more detail, with construction by direct employment and by contract; advertising and letting contracts; and contract documents. The last part of the book covers the preparation of specifications for materials, processes, machinery, and engineering work. Forms, as well as a complete set of specifications for a construction job, are included.

DAVISON'S TEXTILE BLUE BOOK. 91st edition 1956, Davison Publishing Company, Ridgewood, N. J. 1284 p., 5 × 8¼ in., bound. $7.25 (Handy edition), $9.75 (Office edition). This standard guide to the textile industry lists manufacturers of cotton, woolen, worsted, carpet, rayon, silk, and synthetic fabrics, giving principal officers, capitalization, number and types of machines, number of employees, and specialties. It also contains information on knit goods mills, dyers and finishers, associations, schools, etc. The main lists are geographical, with indexes by mills, dryers, and raw cotton firms.

DEUTSCHER AUSCHUSS FÜR STAHLBETON. *Heft 106*. Fahrbahnplatten von Strassenbrücken. By H. Rüsch. Third edition. 82 p., 8¼ × 11⅞ in., bound. DM 24.00. *Heft 121*. Gas und Schambeton. By H. Rüsch, O. Graf, H. Schäffler. 37 p., 8¼ × 11⅝ in., paper. DM9.00. 1956, Wilhelm Ernst und Sohn, Berlin, Germany. No. 106. Design tables for loads on roadway plates of highway bridges. These tables conform to German Standard DIN 1072 covering "permissible loads on. . .bridges." A brief discussion of the theory of plates precedes the tables. No. 121. Three research papers on gas and air-entrained (porous) concrete: tests on shear in beams of reinforced, air-entrained concrete; moisture in steam-cured air-entrained concrete; tests on shrinkage and expansion.

ELEKTROMECHANISCHE SCHALTUNGEN UND SCHALTGERÄTE. By Otto Plechl. 1956, Springer-Verlag, Vienna, Austria. 224 p., 6¼ × 9¼ in., bound. $5.70. This manual is designed to provide a thorough grounding in the theory of electromechanical switchgear as well as an extensive treatment of the calculations necessary for effective design. The examples are presented in such a way that the practical man can compare his previous method of handling with that given in the book.

ELEVATED-TEMPERATURE PROPERTIES OF COPPERS AND COPPER-BASE ALLOYS. (Special Technical Publication No. 181.) Compiled by a Joint Committee ASTM-ASME. 1956, The American Society for Testing Materials, Philadelphia, Pa., 244 p., 8½ × 11 in., paper. $5.50. A graphical summary of data on the mechanical properties of about 50 alloys and types of copper, mainly at temperatures of 300 to 900 F, but, in a few cases, up to 1500 F. The data includes modulus of elasticity; tensile strength; yield strength; reduction of area; elongation; stress for creep rates of 0.000001, 0.00001, and 0.0001 per cent per hour; and stresses for rupture in 100, 1000, 10,000, and 100,000 hours. The accompanying data sheets from which the graphs were prepared also give chemical composition, shape, sizes, and processing information on the specimens tested.

THE EMBRITTLEMENT OF METALS. By B. R. Queneau. Bibliography compiled by G. A. Ratz. 1956, The American Society for Metals, Cleveland, Ohio. 90 p., 6 × 9¼ in., bound. $3. The first of these lectures is a general treatment of the subject, covering embrittlement resulting from a phase change and embrittlement by gases. The other three lectures deal with temper brittleness in low and medium carbon-alloy steels, tempered martensite brittleness in hardened steels, and embrittlement in stainless steels. The accompanying bibliography consists of 215 selected references.

ENGINEERING ANALYSIS. By Stephen H. Crandall. 1956, McGraw-Hill Book Company, Inc., New York, N. Y. 417 p., 6 × 9¼ in., bound. $9.50. This monograph is concerned with the analysis and numerical solution of complex engineering problems. The first three chapters deal with equilibrium, eigenvalue, and propagation problems in systems with a finite number of degrees of freedom; the last three chapters, with similar types of problems in continuous systems. In each chapter, representative problems from such fields as elasticity, heat transfer, fluid mechanics, and electric circuits are presented. Mathematical models for these are then formulated, and the classical mathematical theory reviewed before proceeding to the discussion of numerical procedures. Procedures suitable and machine computation are given, including iteration, relaxation, perturbation, and finite difference methods.

ENGINEERING FLUID MECHANICS. By Charles Jaeger. Translated from the German by P. O. Wolf. 1956, Blackie and Son, Glasgow, Scotland. 529 p., 6¼ × 9⅜ in., bound. 60s. The chief aim of the book is to present the methods of analysis and calculation required in using water for power. The four major sections of the book deal with fundamental hydraulic principles, steady flow, unsteady flow, and flow in underground strata. Particular attention is paid to basic hydrodynamic equations, open-channel flow, surge tanks, and water hammer. Numerous bibliographical footnotes are included. The book is a revised and enlarged version of the author's "Technische Hydraulik," published in German in 1949 and in French in 1954.

EXAMPLES IN MECHANICAL VIBRATIONS. By John Hannah and R. C. Stephens. 1956, Edward Arnold, London, England. Available from St. Martin's Press, Inc., New York, N. Y. 152 p., 5½ × 8¾ in., bound. $4.50. This book consists of seven chapters dealing with free vibrations, transverse vibrations of beams, whirling of shafts, torsional vibrations, and damped, forced, and forced-damped vibrations. Each chapter contains a brief review of the subject, including the derivation of the formulas used, a set of worked examples, and a list of unworked examples, with answers. The book is intended as an aid to those preparing for British university and professional examinations.

William C. House, Aerojet-General Corporation.

William H. Pickering, Jet Propulsion Laboratory, California Institute of Technology.

Simon Ramo, Ramo-Wooldridge Corporation.

Maj. Gen. Bernard A. Schriever, Western Development Division, Air Research and Development Command.

Russell K. Sherburne, New Mexico College of Agriculture and Mechanical Arts.

Fred S. Whipple, Harvard University.

Maj. Gen. Donald N. Yates, Air Force Missile Test Center.

Fellowships in Nuclear-Energy Technology Available

APPLICATIONS are now being accepted for participation in the program of special fellowships in nuclear-energy technology recently announced by the U. S. Atomic Energy Commission. The program has been established by the Commission to encourage qualified students to pursue courses of study in the fields of nuclear science and engineering. The fellowships are part of the Commission's general program of assistance in the field of education, with the goal of lessening the manpower shortage in the area of nuclear-energy technology.

The program will be administered by the Oak Ridge Institute of Nuclear Studies, which now administers for the Commission the special fellowships in radiological physics, the special fellowships in industrial hygiene, and the ORINS graduate fellowship programs.

The fellowships are open to students with the bachelor's degree in engineering, chemistry, mathematics, or physics, who have completed a course in ordinary differential equations. Applicants must be United States citizens and be granted fellowship clearance by the Commission. Before fellowship appointments become effective, the applicant must be accepted as a graduate student, as a candidate for a master's degree, by an institution offering the necessary program of study.

The Commission is making a selection of programs of graduate study which meet the fellowship requirements. Institutions offering these programs will be listed with the application forms and applicants may choose their institutions from this list.

The program of study will include the following courses: nuclear physics, nuclear-reactor analysis, nuclear-reactor technology, radiochemistry and reactor materials, and advanced mathematics.

Applications for the Nuclear Energy Technology Fellowship may be obtained from the Fellowship Office, Oak Ridge Institute of Nuclear Studies, Post Office Box 117, Oak Ridge, Tenn. Completed applications, supporting letters of reference, and transcripts must reach ORINS not later than February 15, 1957, to ensure consideration. The final selection of candidates will be made by a Fellowship Board, and appointments will be announced about March 15, 1957.

1955-1956 UET Report Highlights New Engineering Center in New York

Engineering Societies Library and The Engineering Foundation Report

THE United Engineering Trustees, Inc., recently released its annual report of the fifty-second year, 1955-1956, of its operation. The report was issued by UET President Walter J. Barrett. The following notes and excerpts are from Mr. Barrett's report:

New Engineering Societies Center

Plans for the new Engineering Societies Center were reported in the December, 1956, issue of MECHANICAL ENGINEERING, pages 1179-1180.

The sum of $50,000 has been appropriated ($40,000 by UET and $10,000 by AIChE) to defray the cost of preliminary plans and sketches covering various alternative construction and reconstruction proposals accompanied by estimates of building cost. Architects and engineers have been engaged for this preliminary work, which is scheduled to be completed early in 1957.

Engineering Societies Building

Until such time as a new building is provided or the present one modernized and expanded, a period possibly as long as five years, we must presumably make use of the present structure. This will undoubtedly involve maintenance expense because of the unsatisfactory condition of some of the facilities. Water, sewer, and steam pipes are being constantly renewed. We are currently finding it necessary to replace vital parts of the heating system as a makeshift to avoid an entirely new plant. The original windows and doors have been patched to the point where the next move will have to be complete replacement. Naturally, under the circumstances, as little as possible will be spent on these maintenance items pending the completion of the major construction project.

It is with great regret that the removal from the building, during the year, of the Society of Automotive Engineers is noted. The growth of this great engineering society, which has had headquarters in the building since 1909, has exceeded our ability to accommodate it. It is to be hoped that with the completion of our new engineering center these good friends may return. In the meantime they have our best wishes for continued growth and success. The space so vacated has been taken over by The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Welding Society.

As a result of a wage increase for the building service employees, and the decrease in the proportion of space occupied by associates after the removal of SAE, it became necessary, effective Oct. 1, 1956, to increase rental rates by 10 per cent. The resultant rate is still below commercial rentals of comparable quality in mid-Manhattan in spite of our greater services and longer operating hours.

Finance

During the year the Engineering Foundation was the recipient of a block of General Motors common stock from Prof. Orlan W. Boston, Fellow ASME. His generosity is gratefully acknowledged.

In 1931 Edwin H. McHenry died, leaving Engineering Foundation as residual legatee. The last heir died in February, 1956, which makes UET, Inc. for Engineering Foundation the outright beneficiary. The estate is now being closed. After taxes it is expected to be worth approximately $400,000 "as a special trust fund for the furtherance of research in science and engineering." The fund is dedicated to the memory of the donor's wife, Blanche H. McHenry. These generous gifts will enable Engineering Foundation to undertake additional projects for the Societies and thus broaden the scope of the Foundation's research activities.

The funds managed by the Corporation were given for specific purposes, in many cases with the provision that the principal remain intact, the income only to be used for research activities of Engineering Foundation, operation of Engineering Societies Library, and the like. These contributory funds are held in a Combined Fund amounting to $1,383,227.95 book value. The investments are selected for safety and generally retained until maturity or until there is sufficient justificaton for replacing any item. The rate on the investment amounted to 5.40 per cent on book value during the past fiscal year.

The Depreciation Fund for the building had on Sept. 30, 1956, a book value of $1,100,365.30, and a market value of $1,328,900 with a rate of 4.06 per cent on book value. This fund is invested for safety of principal but in securities which are readily marketable for use on demand for the new building. The fund is increased yearly by an appropriation of $20,000 from building income as well as by earnings of its investments, which during the year amounted to $44,729.81.

All our securities are held in custody by the Chemical Corn Exchange Bank, Customers' Securities Department. All accounts are audited at least twice yearly by Haskins and Sells, Certified Public Accountants.

Professional Advisers

The Board of Trustees retains advisers on all phases of its work in order to obtain the best technical information available. They are: Financial Counsel, W. Barton Cummings, vice-president, Chemical Corn Exchange Bank; Investment Adviser, Wood, Struthers & Company, M. S. Harrison, Partner; Legal

Among those seated at the dais during the Honors Night Dinner of the American Rocket Society are, *left to right*, G. Edward Pendray, Mem. ASME and Fellow Member ARS; Hermann Oberth, recipient of the G. Edward Pendray Award; William F. Ryan, ASME President; Donald Crabtree, Purdue University, winner of the ARS Student Award; and E. R. Sharp, president, Institute of the Aeronautical Sciences

American Rocket Society Has Successful Annual Meeting

Space law, high-temperature materials, rocket-production techniques among subjects discussed

The eleventh annual meeting of the American Rocket Society, an affiliate of ASME, was held in conjunction with the Annual Meeting of The American Society of Mechanical Engineers. The meeting took place at the Henry Hudson Hotel, New York, N. Y., Nov. 26–30, 1956. Designed especially to cover the interests of a fast-growing membership, it drew a record registration of more than 1200 members and guests.

Technical Program

The eleven technical sessions—at which 48 papers were presented—dealt with such varied subjects as reliability, atomization and sprays, combustion, and liquid and solid-propellant rockets. Two of the sessions, on high-altitude sounding rockets, disclosed the latest unclassified information in that field here and abroad and included a discussion of future sounding rockets as well.

At another session the development of low-weight, high-strength materials that can withstand the tremendous heat and corrosion encountered by vehicles in hypersonic flight at extreme altitudes was discussed. One of the most promising developments is the creation of four new arc-cast molybdenum alloys. These alloys are said to have higher useful strength at temperatures over 1600 F than any other material now known. For temperatures over 2400 F, ceramic and vapor-deposited molybdenum-disilicide coatings, it is claimed, show promise of long-time protection where mechanical impact, high stresses, or severe thermal shock are not involved.

Space-Flight Symposium

The popular Space-Flight Symposium, dealing with problems likely to be encountered by the artificial satellites scheduled for launching during the International Geophysical Year (1957–1958), included papers on "A New Type of Nuclear Power for Space Flight," "Lifetime of Artificial Satellites," "Skin Temperatures of a Satellite," and "Heat Transfer to Satellite Vehicles Re-Entering the Atmosphere."

New York Section Film Night

On Wednesday night the ARS New York Section sponsored a program calculated to attract the rocket engineer interested in interplanetary flight. Among the films shown were: "Challenge of Outer Space," distributed by U. S. Army Ordnance; "Flight Into the Future (Bell X-2)," by Bell Aircraft Corporation; and "From Here to Infinity," by North American Aviation, Inc.

Honors Night Dinner

The high light of the meeting, the ARS Honors Night Dinner, attracted nearly 700 members and guests who witnessed the presentation of awards and fellowships to outstanding individuals in the jet-propulsion field. The newly elected ARS president, Commander Robert C. Truax, attached to the Air Force Air Research and Development Command's ballistic missile program, presided.

Admiral Russell Main Speaker

Rear Admiral James S. Russell, Chief, U. S. Navy Bureau of Aeronautics, guest speaker at the event, spoke on the topic, "Rocket Power in the Navy." He reviewed briefly the development of rocket and guided missile systems, describing the quiet production of JATO rocket engines in World War II, the building of one-man helicopters during the Korean War, and the development of the three surface-to-air missiles, TALOS, TERRIER, and TARTAR.

The latter, he said, will be a replacement for 5-in. naval gun batteries. In mentioning the Regulus, Admiral Russell remarked that the Navy now has ten ships which carry this guided missile. In five more years, he added, the Navy will have eight TALOS and 17 TARTARS.

In discussing the bold proposition of space travel, Admiral Russell said it was interesting to note that an entirely new nomenclature and terminology have been established and standardized before the event has taken place.

In conclusion, Admiral Russell stated that the military can and will contribute greatly to the future research which the American Rocket Society fosters in advancing a new frontier in science.

Awards and Fellowships

The following awards were presented to the following outstanding contributors in their respective fields:

Robert H. Goddard Memorial Award to C. C. Ross, Mem. ASME, Aerojet-General Corporation.

C. N. Hickman Award to Bruce Sage, California Institute of Technology.

G. Edward Pendray Award to Hermann Oberth, Army Ballistic Missile Agency.

ARS Astronautics Award to Joseph Kaplan, University of California at Los Angeles.

James H. Wyld Memorial Award to L. G. Dunn, Ramo-Wooldridge Corporation.

ARS Chrysler Award to James Blackmon, Charlotte, N. C.

ARS Student Award to Donald Crabtree.

Recipients of Fellow Memberships in the ARS were:

Charles W. Chillson, Curtiss-Wright Corporation.

At the president's reception preceding the ARS Honors Night Dinner are Commander Robert N. Truax, *left*, incoming ARS President, and Rear Admiral James S. Russell, Chief, Bureau of Aeronautics, who was the guest speaker

effectiveness as a catalytic agent in that its sponsorship and grants of $70,000 have made it possible to accomplish worth-while engineering research valued at about half a million dollars.

Distribution of Foundation Grants

The distribution of Foundation grants among the Founder Societies and independently for the current fiscal year, ending Sept. 30, 1956, is as follows:

ASCE	6 projects	$11,500	16.2 %
AIME	10 projects	33,500	47.5 %
ASME	5 projects	8000	11.4 %
AIEE	3 projects	6850	9.8 %
Joint Society activities	2 projects	6000	8.6 %
Independent research	3 projects	4500	6.5 %
Total	29 projects	$70,350	100.0%

There are two noteworthy features of this brief statistical summary: (1) ASCE has three new projects this year, and (2) for the second consecutive year AIME has submitted to the Foundation applications for research of such high quality that they have accounted for the appropriation to these projects of nearly half of the Foundation's available funds for research.

The highly important new ASME project on Properties of Steam (EF 113) is now actively under way, and five programs of research involved total commitments of $226,000 for one to four years have been approved by the committee in charge. The anticipated total American expenditure necessary to bring the international steam tables up to pressures of 15,000 psia and temperatures of 1500 F is $125,000 a year for four years.

E. L. Robinson and R. C. Allen represent ASME on The Engineering Foundation Board.

Public Relations Committee

The Public Relations Committee approved three releases during the year: one, on the Storm Surges project (EF 118), on November 24, 1955; a second, describing new Foundation grants, on May 4, 1956; and a third, on September 25, 1956, on the bequest of approximately $425,000 made to the Foundation by Edwin H. McHenry. All these releases were widely reprinted in the technical press.

Heidelberg Control Meeting Attracts International Group

Reported by R. N. Bretoi[1] and Rufus Oldenburger[2]

An international automatic control meeting called Tagung Regelungstechnik, under the sponsorship of the VDI (Verein Deutscher Ingenieure) and VDE (Verband Deutscher Elektrotechniker) was held at the University of Heidelberg Sept. 25 to 29, 1956. More than 850, of whom about 250 came from outside of Germany, registered to attend the meetings. The meeting was organized by the VDI-VDE Control Committee of which Dr. G. Ruppel is the secretary. The VDI and VDE correspond to The American Society of Mechanical Engineers and the American Institute of Electrical Engineers, respectively. The VDI and VDE have 32,000 and 20,000 members, respectively.

At the initial session which was attended by 1000 people, the rector of the University of Heidelberg introduced Dr. O. Grebe, general chairman of the meeting, who officially opened the meeting. He was followed by R. Oldenburger of the United States and A. M. Letov of Russia, who brought greetings from The American Society of Mechanical Engineers and the Institute of Automatics and Telemechanics in Moscow, respectively. The session closed after general lectures by J. Jannsen from Holland, R. Oldenburger, of the United States, and A. M. Letov of Russia.

The lectures by J. Jannsen and R. Oldenburger concerned the theme of the meetings, namely, the role of mathematical methods in the design of automatic controls, the first being concerned with elementary methods, and the second with advanced methods.

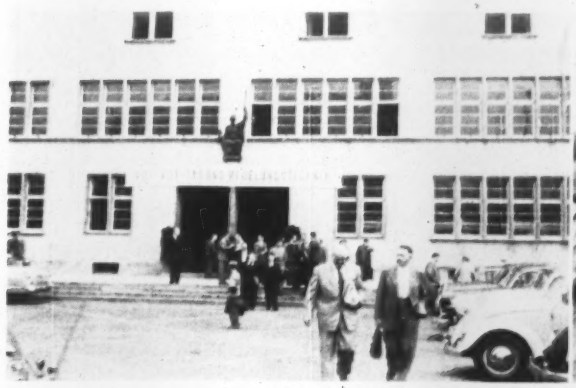
The Russian address, by W. A. Trapeznikov and B. J. Kogan, was read by Professor Letov, editor of the Russian *Journal of Automatics and Telemechanics*. This address was devoted to the use of electronic analogs of controlled systems. This paper pointed out that multiplication is generally performed by using the formula

$$xy = \frac{1}{4}[(x+y)^2 - (x-y)^2]$$

This gives poor results when the factors are near zero, and has been superseded in the United States by better methods involving areas.

Sixteen men from the United States and four from Russia, plus a Russian-German interpreter, attended the meeting. Professors B. N. Naumov, J. S. Tsypkin, A. M. Letov, and V. A. Ratchejev represented Russia. Mr. Ratchejev also acted as a Russian-German interpreter. Professors Naumov, Tsypkin, and Letov spoke a little English. Their lectures were given in Russian with immediate translation into German by an interpreter.

Representatives from East Germany, Poland, and Czechoslovakia were present in force. It was apparent that the control experts from these countries were eager to establish contacts with representatives from the West.



Photo, *left*, shows participants in the Heidelberg international automatic control meeting leaving the building where the meeting was held. The meeting participants were taken on a boat trip along the Neckar River. The photo, *right*, shows A. M. Letov of Russia, *extreme right*, Dr. Oldenbourg, *fourth from right*, an author contributing to ASME book entitled "Frequency Response"; and Professor Tsypkin of Russia is seated directly in front of the flag.

[1] Minneapolis Honeywell Regulator Co., Minneapolis, Minn.

[2] Purdue University, Lafayette, Ind. Mem. ASME.

Counsel, Simon Presant (formerly Parker and Aaron); Consulting Architects, Shreve, Lamb and Harmon Associates; Consulting Actuary, George B. Buck; Insurance Counsel, Frank & DuBois; and Auditors, Haskins & Sells, Certified Public Accountants.

To all of these we are deeply grateful for their expert assistance in the handling of our affairs.

Personnel

In view of the approaching retirement of John H. R. Arms, Secretary-General Manager since 1933, the Board of Trustees, after careful consideration of a number of candidates, selected Steven William Marras to become assistant to Mr. Arms on Aug. 1, 1956. Mr. Marras, who is a member of AIEE, was formerly Secretary of the Electrical Section of the Association of American Railroads in Chicago.

Engineering Societies Library

The number of persons using the ESL increased again this year—the increase being seven per cent. Over 75,000 photoprints were supplied to users. This is 15 per cent more than the previous year. Such increased use of the Library in a year in which one third of the staff resigned made this a rugged year for continuing staff members. Librarians with technical training are scarce. It was necessary to make substantial salary increases durthe year, yet some staff positions remained unfilled for months because of the scarcity of qualified personnel.

Unlike most libraries the ESL can be used without even going to the Library. Members and other engineers from all over the world use the ESL by mail, telephone, and telegraph. Over one half of the 43,000 persons who used the ESL during the year did not come to the Library. Most orders for photoprint and microfilm copies of articles, for bibliographies, book loans, literature searches, and translations are received by mail.

Statistics of Library Use

	1954–1955	1955–1956
Photoprint orders	4598	5127
Photoprints	65,728	75,627
Microfilm orders	330	364
Bibliography orders	781	467
Searches and paid services	142	124
Translations	204	233
Words translated	425,156	356,906
Borrowers	1357	1262
Books loaned	1753	1646
Telephone inquiries	10,501	10,711
Written replies to inquiries	3827	3835
Visitors served—total	18,696	21,023
Nonvisitors served—total	21,740	22,123
	40,436	43,146

Income from paid services supplied by the ESL has doubled in the last six years. Much of this may be due to increasing business and research activity, but some is doubtless due to continuing promotion of the ESL which has been emphasized during recent years.

Service Bureau Rates

It was found necessary to increase some rates. No changes had been made since 1948. Rates now are:

Searches:

$6 per hour—a $1 increase.

Translations:

German, French, Italian, and Spanish, into English $1.50 per hundred words—no increase.

Russian, Dutch, Portuguese, and Swedish, into English $2.25 per hundred words—a $0.25 increase.

Quotations on other languages are made on request.

Photoprints:

$0.45 per print—a $0.05 increase. Now all photoprints are sent first-class mail.

Microfilms:

$1.50 for a copy of one article in one volume for each 40 pages or fraction thereof—formerly no limit on number of pages.

Book Loans:

Only members may borrow books. $0.50 per week or fraction of a week for each volume borrowed—no increase.

The Library Collection

Continuous examination of lists of publications, book reviews, publishers' notices, and other listings of new publications is a necessary step in the maintenance of an excellent library collection. Careful selection of books, reports, and periodicals likely to be of value to users of the ESL, who are primarily graduate and practicing engineers, is a second step, and the third step is systematic and thorough classification, cataloging, and indexing so that the information in the publications can be readily found. All of the above-mentioned have been kept up to date and were well done.

Periodicals received:	1954–1955	1955–1956
Subscription	370	375
Exchange	291	292
Gift	765	772
	1426	1439

Miscellaneous Activities

The Library Staff prepared reviews of 563 books valued at $3900. The books were received from publishers in many countries. From these reviews, editors of eight publications selected and published those reviews of interest to their readers. The publications using the Library's reviews are: Civil Engineering, Electrical Engineering, Engineering Index, Journal of the Engineering Institute of Canada, Journal of Metals, Journal of Petroleum Technology, Mechanical Engineering, and Mining Engineering. The Library also paid $2165 for books that were not reviewed, and $5114 for periodicals.

ESL Bibliography Number 11 entitled "Bibliography on Machinery Foundations" was issued. It is a revision of ESL Bibliography Number 5.

A new procedure is the use of rubber stamps to expedite replies to many letters about photoprint and microfilm copying. Use of the rubber stamps makes for more accurate replies, and it saves staff time. Appropriate statements are stamped on the inquirer's letter or order. A photoprint copy is then made and sent to the inquirer.

Models and parts made by John Ericsson, given to the UET in 1907 by the Metropolitan Museum of Art, have been on loan since 1934 to the Museum of the American-Swedish Historical Foundation in Philadelphia. For over 25 years the ESL has had an uncataloged and unused collection of papers by and about John Ericsson. The ESL also had a few other items such as Ericsson's spectacles, razor, and pocket knife. All of the above have been given to the American-Swedish Historical Foundation.

The ESL received a set of records of the American Engineering Council. The records cover the 20 years of achievement of the Council which pioneered in joint activities in the engineering profession.

The Library's extensive holdings of periodicals were checked for record in the coming new edition of the "List of Periodicals Abstracted by Chemical Abstracts." This list, which has world-wide use, helps in the location of scientific and technical periodicals.

The Library's new periodical and serial titles were checked for record in "New Serial Titles" published by the Library of Congress. This publication is useful for the identification and location of recently published material.

The Director was elected vice-president of the Board of the Engineering Index. He is a member of the ASA Committee Z39 on Standardization in Library Work and Documentation. He is chairman of the Subcommittee on Selection of Scientific and Technical Periodicals to be indexed in the Industrial Arts Index. He is a member of the Special Libraries Association's Photographic Reproduction Committee, also of EJC's Panel on Abstracting Services, and adviser to the "Booklist" which is published by the American Library Association.

The Engineering Societies Monographs Committee, of which the director of the Library is chairman, considered three original manuscripts. One was rejected, one tentatively accepted, and one accepted and published. It is "Engineering Analysis; A Survey of Numerical Procedures" by Stephen H. Crandall. Royalties received by the Library since the Engineering Societies Monographs series started in 1931 amount to $13,389.43.

The Engineering Foundation

At the forty-first annual meeting of the Board of Engineering Foundation on May 5, 1955, and at the semi-annual meeting on Oct. 13, 1955, grants totaling $70,350 were made toward the support of 29 projects. Contingencies set by the Board for eight projects totaled $102,500, and estimated industry support for all the projects will be at least $450,000. The Foundation has again demonstrated its

- Government expenditures at all levels should rise somewhat.
- The upward trend of the construction industry should continue.
- Highway expenditures should rise $750 million to 8.5 billion.
- Expenditures for capital equipment are expected to increase even from the tremendous current demand.

The vital importance to the entire economy of the annual model change idea pioneered by the automobile industry was emphasized in remarks preceding Mr. Curtice's by Paul Garret, GM vice president in charge of public relations staff. Questioning of the economic value of the annual model change reflects "a fundamental failure of people to understand the economics of our industry," Mr. Garrett said.

"Actually, our system, instead of causing waste, creates wealth," he said. "The customer gets more for his money than he could possibly get if the industry did not spend millions each year on model improvements."

Because of the annual model change, Mr. Garrett pointed out, millions of Americans are able to own personal transportation in the form of good used cars. He said that 25 million of the 48 million passenger cars in use in the United States are used cars.

The annual model change pattern is followed not only in the automotive industry, but also in many others, Mr. Garrett said, and "has contributed to the highest standard of living in the world."

People

Honors and Awards. Reinhold Rudenberg, inventor of the electron microscope and professor emeritus of Harvard University, was honored November 19 with a document and medal conferring the rank of Honorary Senator of the Berlin University of Technology, presented to him by the German Consul, Dr. Werner L. von Holleben, in Boston, Mass. He invented the electron microscope in 1931 in Hanover in an effort to find a better instrument with which to study poliomyelitis after his son was stricken with the disease.

The Council of the American Society of Heating and Air Conditioning Engineers will confer the newly established grade of Fellow on five members of professional distinction, including three past-presidents, during the 63rd annual meeting of the society, Feb. 25–28, 1957, at the Conrad Hilton Hotel in Chicago, Ill. The five were: Walter L. Fleisher, Mem. ASME, New York, N. Y.; L. N. Hunter, Mem. ASME, Johnstown, Pa.; J. D. Kroeker, Mem. ASME, Portland, Ore.; Charles S. Leopold, Philadelphia, Pa.; and Samuel R. Lewis, Chicago, Ill.

Comfort A. Adams, Fellow ASME, oldest past-president AIEE, and Harvard professor emeritus, will be awarded the 1956 Edison Medal during the AIEE Winter General Meeting at the Hotel Statler, New York, N. Y., Jan. 21–25, 1957, for "pioneering achievements in the development of alternating-current electric machines and in electrical welding; for vision in the formation of an engineering standards organization, and for eminence as an educator and consulting engineer."

Edward Warner, Mem. ASME, Stamford, Conn., retired president of the Council of the International Civil Air Organization, a United Nations Agency, has received the Wright Brothers Memorial Trophy for 1956. Dr. Warner has served as ICAO Council president for more than ten years, he was also Assistant Secretary of the Navy for Aeronautics from 1926 to 1929 under President Coolidge. His contributions to aviation include the construction of the first wind tunnel for the land-testing of aircraft.

University of Wisconsin student Ronald L. Kausch recently received from the Wisconsin Chapter, American Society of Heating and Air Conditioning Engineers, the first G. L. Larson Award, established in memory of the late professor of mechanical engineering, awarded to a senior in that field.

Robert Roy White, professor of chemical engineering, University of Michigan, has been selected as winner of the 1956 Professional Progress Award in Chemical Engineering of the American Institute of Chemical Engineers, which was presented at the 49th Annual Meeting of the Institute in Boston, Mass., held from Dec. 9 to 12.

Francis C. Flint, technical director, Hazel-Atlas Glass Division, Continental Can Company, has been chosen to receive the 1957 Albert Victor Bleininger Award given annually since 1948 by the Pittsburgh Section of the American Ceramic Society. Presentation will be at the Penn-Sheraton Hotel, Pittsburgh, Pa., on March 15.

Mohammed Mortada of Dallas, Texas, senior engineer, Magnolia Petroleum Company, will receive the Alfred Nobel Prize, the major award of five top engineering organizations to a young engineer for an outstanding paper, to be conferred at the annual AIME meeting in New Orleans, La., Feb. 24–28, 1957.

New York University researchers use helicopter for Airport 'Smog' Study. At LaGuardia Field, New York University research engineers, Gerald Palevsky, *left*, and William T. Ingram, *center*, discuss flight plans with pilot Marcel Chevalier. The NYU engineers flew over LaGuardia, Idlewild, and Newark airports and over heavily industrialized areas as part of a new study of fogged-in and smogged-in airports. NYU's Engineering Research Division is conducting the research under sponsorship of the Flight Safety Foundation, Inc.

They expressed the hope that these contacts, besides facilitating the interchange of scientific information between East and West, would increase the chances for world peace.

About 20 German control experts, sentenced to five-year terms of work in Russia and released upon the completion of their sentences, attended the Heidelberg meeting. Paid twice as much as their Russian counterparts, they were confined to living and working quarters, which they could leave only with official permission, in groups of 10; at least 3 of the 10 had to be Russians. Among these were rocket-control experts. They reported amazement that they were able with ease to obtain any western literature they needed, although much of the Russian material was available only to the Russian engineers. These former prisoners speak Russian and were of great help as translators at the Heidelberg meeting.

The papers were presented in French, Russian, English, and German. Sometimes a Russian scientist would comment in Russian on a paper presented in English. The communication here involved translation from Russian to German, and then from German to English, and vice versa. Although this appears inefficient, the system worked remarkably well.

The papers covered all major areas of automatic control. Means for decoupling multiple-loop controls with the aid of matrices, frequency response, nonlinear systems, the use of statistical methods in minimizing errors and determining transfer functions, means for optimizing controls (with various definitions of "optimum"), analogies between stochastic and dynamic processes, and the use of computers were treated. There was much emphasis on nonlinear control systems with 11 papers by authors from 7 countries devoted to this subject. Ten of the papers were seriously concerned with the statistical approach.

The work of the Russian participants concerned optimum sampled data systems, means for calculating nonlinear control systems, stability criteria, the self-adjustment of parameters for the optimum performance of a system subject to random disturbances, and structurally (inherently) unstable systems. The Russian papers were by members of the Moscow Institute of Automatics and Telemechanics, which is actively engaged in developing control theory. The contact between theory and practice in Russia does not appear to be so direct as in the United States. Russia is graduating 5000 control engineers a year.

A number of papers were concerned with the application of theory to various physical problems, among them the control of steam generators, water turbines and diesel engines, the charging of storage batteries, the automatic longitudinal control of aircraft, the regulation of the impedance of electric arc furnaces, the control of machine tools, and the regulation of temperature. It is clear from these papers that much of automatic control theory is finding immediate application in industry.

L. S. Dzung of Switzerland showed that for systems with multiple controls, these controls could be uncoupled through the use of the reciprocal of the transfer matrix of the plant. He applied this to an extraction steam turbine. A. Nomoto of Japan pointed out advantages of log-root locus plots. K. Izawa and S. Hayashibe of Japan surveyed criteria for good control response and concluded that for processes, gain and phase margins of at least 3 db and 20 deg and for servomechanisms of 12 db and 40 deg are desirable.

Erick Bukovičs of Austria examined the ease with which stability criteria can be put on digital computers and concluded that the Routh and Leonhard-Cremer criteria are well suited for this purpose.

E. G. C. Burt of England and V. V. Solodovnikov of Russia gave papers on the self-adjustment of controlled systems to give optimum performance for nonstationary random disturbances. Solodovnikov treated stationary random processes in some detail. J. H. Westcott of Great Britain considered processes that need controllers for satisfactory performance. It not being possible to record supply and load disturbances directly, the dynamic characteristics of the process and the controller can be obtained from records of three accessible control-loop signals. This is an extension of work by J. Reswick and others. R. Kochenburger of the United States considered the problem of maximizing the probability that the error in the controlled variable be in a given band. From the spectral density of the disturbances on a water turbine I. Obradović and M. Mesarović of Jugoslavia were able to obtain optimum adjustment of the turbine. Y. Sawaragi and Setuo Takahashi assumed a sine wave plus Gaussian input to a zero memory nonlinear device and secured equivalent gains for these inputs.

Ya. S. Tsypkin of Russia showed how to obtain optimum performance for a sampling control in the case of stationary random disturbances.

Papers by J. C. West of Great Britain, K. Klotter of the United States, Ch. Hayashi of Japan and others were concerned with frequency response for nonlinear systems, nonlinear damping, and other nonlinear phenomena.

What's Ahead for Business?

H. H. Curtice Predictions for 1957

Harlow H. Curtice, president of General Motors, forecast that 1957 would be the automotive industry's second best sales year in history and announced GM anticipated spending $700 million for capital investment during the year.

Speaking before 400 newsmen and guests at a news conference luncheon, Dec. 6, 1956, preceding the opening, Saturday, of the National Automobile Show, Mr. Curtice predicted that the industry will "contribute more substantially to economic progress in the year ahead than it has in 1956."

The GM president emphasized that his predictions were based on the assumption that "the delicate balance of peace will be maintained."

He said that in 1957 the industry should produce and the United States market absorb approximately 6½ million new passenger cars and 900,000 trucks. Including Canadian and export sales, he added, production should approximate 8,300,000 passenger cars and trucks.

The $700 million will be spent, Mr. Curtice said, "both to keep our facilities and products modern and to assure General Motors adequate capacity to keep pace with our appraisal of the normal growth of the market for our products."

This sum is in addition to the nearly $1 billion of GM capital expenditures this year and will bring the corporation's total capital expenditures since World War II to $5,200,000,000.

In addition, Mr. Curtice pointed out, very substantial annual expenditures have been made for special tools.

"To bring the 1957 General Motors models to market," Mr. Curtice disclosed, "required an outlay of approximately $630 million. This is more than we have ever spent in any one year for styling, engineering, and mechanical advances.

"I cite the General Motors record as an example of the contribution to the economy every industrial concern makes and must continue to make if it intends to keep pace with the progress of technology and with the demand for goods from an expanding population."

Mr. Curtice said 1957 would be another good year for GM, exceeded only by 1955.

"We came to market with truly superb lines of passenger cars, trucks, and appliances," he said. "They are outstanding in every respect."

In making his annual economic forecast, Mr. Curtice said he viewed 1957 "as another record year for business generally," presuming the maintenance of peace.

"It has been demonstrated conclusively," he said, "that the prosperity and progress of our nation are not dependent on war or a peak level of defense expenditures."

However, he said he believed defense expenditures would be higher next year—possibly $42 billion.

Of other 1957 economic prospects, Mr. Curtice said:

- Gross national product could go as high as $435 billion.
- The year will be one of substantially full employment.
- Consumer disposable income will rise, possibly to $300 billion.
- Personal consumption expenditures should continue to increase.

sessions, two luncheons, and an evening session designed especially for the general public interest.

C. C. Furnas, Mem. ASME, Assistant Secretary of Defense for Research and Development, will address the public session on Monday evening.

Digital Computers

"Automatic Coding" will be the theme of the Digital Computer Symposium to be held at The Franklin Institute in Philadelphia, Pa., on Jan. 24 and 25, 1957.

A program has been arranged that should be of wide interest to users and potential users of modern digital computing equipment. The greater part of the two-day meeting will be given over to lectures and discussions. However, those who attend will have time to observe a demonstration of the Institute's recently completed UNIVAC Computing Center.

Topics covered by the speakers: An Automatic Coding System for the IBM 705, Automatic Coding Experience at the General Electric Company's UNIVAC Installation in Louisville, Ky., Debugging Automatic Coding, Omnicode, A Common Language Programming System, A Mathematical Language Compiler, The Procedure Translator, A System of Automatic Programming, A Mechanized Approach to Automatic Coding, and A Matrix Compiler for UNIVAC.

For further details, write: Automatic Coding Symposium, Franklin Institute, 20th and Parkway, Philadelphia 3, Pa.

General Management

The sixth West Coast American Management Association General Management Conference will be held January 28–31 at the Hotel Statler, Los Angeles, Calif. One of the principal subjects for discussion will be organization planning. Other topics include management development, cost reductions, communications, sources of funds for financing, electronic data processing, management controls, problems of rapid growth, and administering organizational changes.

Nucleonics in Industry

Commercializing the results of atomic research will be the topic of a special conference on Nucleonics in Industry to be conducted by the American Management Association, February 7–8, Hotel Statler, New York, N. Y.

Principal subjects for discussion will be the present and prospective profitability of atomic investment, the role of government in industrial atomic development, hazards and insurance, and technical and personnel problems. The sessions will cover such industrial applications as the use of nuclear energy for processing purposes, development of auxiliary power, and the use of isotopes.

Reinforced Plastics

Latest developments in both technical and practical aspects of reinforced plastics are featured in the program for the twelfth Annual Technical and Management Conference of the Reinforced Plastics Division of The Society of the Plastics Industry, Inc. The Conference will be held in Chicago, Ill., at the Edgewater Beach Hotel on February 5–7, 1957, and will be open both to members of the Society and to nonmembers.

Subject matter will cover a wide range from reports on research and testing to product design to production methods to marketing techniques. In consequence, there will be sessions of special interest to chemists and engineers, to architects and designers, to top management and sales executives both within the industry and among users and potential users of reinforced plastics. As at past Conferences, a special exhibit of reinforced plastics products is planned.

Throughout the program there will be papers specifically keyed to the interests and experiences with reinforced plastics of the aviation industry, architects and builders, the electrical industry, automobile manufacturers, the oil and gas industry, boat builders, the chemical industry, product designers and manufacturers, tool makers, Government and the Military.

Admiral Rickover Challenges Education—Proposes 25 Model Schools for Gifted Students

Seventh Edison Foundation Institute on "Strengthening Science Education for Youth and Industry"

"Our schools do not perform their primary purpose which is to train the nation's brain power to the highest potential," declared Rear Admiral H. G. Rickover, USN, chief of the naval reactors branch of the U. S. Atomic Energy Commission.

Admiral Rickover who, in the face of many obstacles, was instrumental in building the first atomic submarines when he headed the USS *Nautilus* and USS *Sea Wolf* projects, suggested some changes in engineering and scientific education.

"We shall not do justice to our talented youth" he stated, "until we seek them out at an early age—no later than 10 or 11—and educate them separately from the rest of the children." This should be done, he added, "preferably in separate schools or, if this is not possible, in separate classes."

Pointing out that "There is no general agreement on the definition of the term 'talented,'" Admiral Rickover used talented to mean "the 15–20 per cent of our children and 'brilliant' (to mean) the top one and one half to two per cent."

Admiral Rickover spoke to more than 300 educators, industrialists, and Government officials at the seventh Thomas Alva Edison Foundation Institute on strengthening science education for youth and industry. The In-

J. R. Dunning, *left,* Mem. ASME, dean of engineering school, Columbia University, discusses the work of Edison Foundation at the Seventh Institute, with C. F. Kettering, *center,* Fellow ASME; president Edison Foundation; and world-famous GM scientist and inventor; and the Hon. Charles Edison, former Governor of New Jersey and honorary president of the Foundation

Appointment. MARSHALL SITTIG, formerly of Ethyl Corporation, has been elected president and managing director of the new American Lithium Institute, Inc., established for research purposes by the three major U. S. lithium producers. Mr. Sittig is widely known for his many technical writings in the petroleum field and is an authority on the alkali metals.

New Officers. AUGUSTUS B. KINZEL, vice-president in charge of research, Union Carbide and Chemical Corporation, has been elected president of the AIME for one year beginning February, 1958, to succeed president-elect GROVER J. HOLT of Ispheming, Mich., general manager of the ore-mining department of the Cleveland-Cliffs Iron Company, who takes office this February. Outgoing AIME president is CARL E. REISTLE, JR., of Houston, Texas, vice-president of Humble Oil & Refining Company.

JOHN T. HENDERSON, principal research officer, National Research Council, Ottawa, Ont., Canada, is president-elect of IRE for 1957. He succeeds ARTHUR V. LOUGHREN, color-television consultant. YASUJIRO NIWA, president, Tokyo Electrical Engineering College, Tokyo, Japan, will succeed HERRE RINIA, director of research of the Philips Research Laboratories in Eindhoven, Holland, as IRE vice-president.

JOHN CHARLES NIEDERMAIR has received the 1956 Award for Professional Achievement of the Association of Senior Engineers of the Navy Department's Bureau of Ships.

JOSEPH WARREN BARKER, outgoing president and Mem. ASME, has been elected president of EJC for 1957. Dr. Barker, chairman of the board and president of the Research Corporation, will take office in January, 1957. FISCHER S. BLACK, editor and publisher, *Electrical World*, will be vice-president.

W. L. EVERITT, dean of the College of Engineering, University of Illinois, was elected president of the American Society for Engineering Education for 1956–1957. Other officers newly elected include C. A. BROWN, vice-president for instructional division activities; R. J. WOODROW, vice-president, representing the Engineering College Research Council; and JOHN GAMMELL, Affiliate ASME, treasurer.

Editorial Items. EDWARD H. ROBIE has retired as AIME secretary emeritus. A member of AIME since 1919, he became assistant secretary in 1932, secretary, 1949, and secretary emeritus, 1955. Editor of the supplement to "The Porphyry Coppers," by A. B. Parsons, to be published in 1957, and editor-in-chief of a new volume to be published in 1958 on mineral economics, his early career was with the Canadian Copper Company and International Nickel Corporation before he became assistant editor and later associate editor of *Engineering and Mining Journal*. He also served as associate editor of *Engineering and Mining World* and of *Metal and Mineral Markets*.

EVERETT S. LEE, Fellow ASME, editor of the *General Electric Review* since 1951, retired in November, 1956. As editor he has served with professional distinction. He has set a durable example both as a discerning editor and as a stimulating spokesman for his engineering profession.

Campus Data. ALFRED DEL VECCHIO will be professor-in-charge of a new BME curriculum at the School of Engineering of Manhattan College, Riverdale, N. Y. JAMES Z. MILLIAN was appointed lecturer in thermodynamics and ALBERT ROGEL, heat and power laboratory assistant, with two additional appointments to be made in September.

CHARLES E. WILSON, Hon. Mem. ASME, formerly president of General Electric Corporation, is chairman of a new policy-forming Council on Educational Affairs to assist Manhattan College in its plan for an engineering center. Mr. Wilson's executive committee will comprise Brother AUGUSTINE PHILIP, President of the College; Commissioner ROBERT MOSES; Brother AMANDUS LEO, dean of the Engineering School; four members of the College's Board of Trustees; and chairmen-to-be of seven consulting groups.

WILLIAM JOHN GRAFF, JR., Mem. ASME, has been appointed professor and chairman of the mechanical-engineering department of Southern Methodist University to fill the vacancy created by promotion of Prof. RAY M. MATSON, Mem. ASME, chairman since 1937, to director of schedules and admissions.

ARTHUR CUTTS WILLARD, Mem. ASME, president-emeritus of the University of Illinois and a past-president of the American Society of Heating and Air Conditioning Engineers; and four former staff members of the University, RAYMOND B. ALLEN, H. H. MITCHELL, ROBERT W. KEETON, and A. P. KRATZ, Mem. ASME, are to be honored at an informal reception and dinner to be held at the Conrad Hilton Hotel, Chicago, Ill., Feb. 25, 1957. The affair will be held during the week of the 63rd annual meeting of the American Society of Heating and Air Conditioning Engineers.

JOHN E. LAGERSTROM, assistant professor of electrical engineering at Iowa State College, Ames, Iowa, becomes assistant to the dean of engineering this month. A member of the faculty since 1946 he continues some teaching duties.

Coming Meetings

Solar Furnace

THE final program for the Solar Furnace Symposium, January 21–22, at Phoenix's Hotel, Westward Ho, has been announced by John I. Yellott, Mem. ASME, secretary of the Association for Applied Solar Energy. Co-sponsors with the Association are Stanford Research Institute, Arizona State College at Tempe, and the University of Arizona.

The symposium has been organized to bring American industry and governmental agencies the latest information on the role of solar furnaces in the study of materials at very high temperatures.

One of the high lights of the program is a visit to the solar furnace at Arizona State College. This furnace has reached temperatures of over 3000 C and is being used in conducting experiments in heat-wave transmission through ceramics.

The program consists of three technical

David Sarnoff, chairman of the board of directors of RCA, and Fred Tanner, president of Precision Instrument Equipment, were inducted into Tau Beta Pi, national engineering society, at the Engineering School of Pratt Institute. Both are alumni "who have conferred outstanding honor on their school by achievements in the field of engineering." *Left to right:* F. H. Horn, president of Pratt Institute; Mr. Tanner; W. A. Paulson, student president, the Pratt Institute or Lambda Chapter of Tau Beta Pi; General Sarnoff; and Alfred W. Doll, Mem. ASME, chairman of the physics department of Pratt Institute.

"Today, technological progress is limited only by availability of trained professionals, and this, in turn, depends on but two factors: Incidence of superior brain power—over which we have little, if any, control; and development of available talent—here we can do much."

Carroll V. Newson, president of New York University, also thought some changes should be made. He said there was too much formal instruction in the junior and senior high schools where about half of the mathematics curriculum has little or no value for the students.

"We try to teach too much anyway," he said.

Herbert Scoville, Jr., assistant director, U. S. Central Intelligence Agency, who compared United States secondary education with that of the Soviet Union, said the United States apparently had "missed the boat." He noted that Russia's broad manpower base was supplied by the secondary schools, where the emphasis was on science and all students receive a comprehensive outline regardless of their individual objectives.

He observed that Soviet teachers had social prestige and received high salaries. They concentrate on the subjects they teach rather than on the methodology of teaching. And every five years they have to submit to competitive examinations to keep them alert, he concluded.

Four panels, with outstanding panelists, covering "Factors in the Early Motivation of Scientists," "The Present State of Science and Mathematics Teaching in the High School," "The Science Education Possibilities in Co-operative Education," and "Science Education in Russia: The Qualitative Aspect," made up an important segment of the program. John R. Dunning, Mem. ASME, dean, School of Engineering, Columbia University, was the principal speaker at the luncheon on the opening day of the conference. His topic of discussion was "A Positive Program for Science Education"; his talk covered the report recently issued by the Advisory Committee on science manpower of the New York City Board of Education.

Mr. Kettering made the welcoming address at the seventh Institute. These conferences were initiated in 1951 and have been devoted to finding ways and means of solving the national shortage of scientists and engineers and clarifying and improving science education.

Small Nuclear Plants

The chief atomic engineer for one of America's industrial pioneers in the nuclear power field stated that small nuclear power plants "are of major importance in the overall atomic-energy program."

Kenneth Kasschau, manager of atomic energy engineering for ALCO Products, Inc., discussed small reactors in a speech at the five-day Power Reactor Conference for Belgium.

Mr. Kasschau said small nuclear-power installations "offer an opportunity to accelerate the development of reactor technology toward the day when major portions of our electric energy may be generated from nuclear sources."

The Brussels conference was sponsored jointly by the U. S. AEC and the Atomic Industrial Forum.

ALCO is building the Army Package Power Reactor (APPR-1) at Fort Belvoir, Va. The reactor is a prototype 2000-kw pressurized-water nuclear generating plant under construction for the U. S. Army and the AEC. It is expected to be in operation early in 1957.

The speaker said one "package" feature of the reactor type represented by the APPR was the negligible weight requirements of the plant for its fuel-uranium and for other materials necessary for operation. Because uranium is so highly concentrated, he said, "trivial shipments are all that are necessary to provide the fuel for long periods of operation."

Mr. Kasschau also told his audience that there was little, if any, factual material available on which to base estimates of the cost of operating a nuclear-power reactor.

Should Standards Be Developed for Industrial Use of Nuclear Energy?

Should safety and technical standards be developed now for the industrial use of nuclear energy? This was one of the questions discussed at the Fifth Annual Meeting of the Standards Engineers Society at Washington, D. C., Oct. 2-5, 1956. Theme of the meeting was "Standards—Guides for Tomorrow." Some 200 members of the society who have responsibility for co-ordination of practices, interchangeability, and specifications in their companies and in government were present. Subjects discussed covered new concepts in building materials; metals standardization; how to organize company standards work; ABC unification; drawing practice; screw threads; antifriction bearings; and standardization in the Department of the Army.

Fellowships were awarded to four members of the Society who have given distinguished service. They are R. C. Sogge, manager of engineering standards, General Electric Company, and President of the United States National Committee of the International Electrotechnical Commission; John Gaillard, Mem. ASME, consultant; Virgil M. Graham, associate director, Radio-Electronics-Television Manufacturers Association; and George F. Habach, Mem. ASME, vice-president in charge of engineering, Worthington Corporation, Harrison, N. J.

Charles J. Eiwen was chosen by the awards committee of the society as winner of the 1956 technical papers contest for his paper entitled "Standardization" Research." The award was presented on behalf of the Washington section of the society. Mr. Eiwen is electrical engineer, Office of Standardization, OASD (S&L), Department of Defense, Washington, D. C.

Organization of six new sections of the society during the past year was announced. Their headquarters are in Montreal, Quebec; Boston; Los Angeles; Hamilton, Ontario; Chicago; and Detroit. This makes a total of 12 sections, the other six having their headquarters in New York City; Binghamton, N. Y.; Hartford, Conn.; Washington, D. C.; Pittsburgh; and Philadelphia, Pa.

In opening the meeting, M. S. Gokhale, RCA Victor Division, Camden, N. J., president of the society, said: "Standards engineers feel that to provide a suitable guide for other branches of engineering is our primary function. With the advent of complex mechanisms required for printed circuitry, automation, electronic computers, and utilization of nuclear energy, it is highly desirable that standardization be considered in the early stages of research and design. And that responsibility is ours."

Vickers Transport Aircraft Hydraulic Conference Held in Detroit

American and foreign airline representatives discuss common problems

Ninety-seven guests representing all leading airlines in this country and those of six foreign countries attended the Vickers 1956 Transport Aircraft Hydraulic Conference in Detroit, Mich., on November 13 and 14. Paul B. Humphreys, assistant manager of system maintenance, Capital Airlines, and Richard B. Ault, director of engineering, Western Airlines, acted as chairmen, each taking two of the four sessions. Following the meetings at the Park Shelton Hotel, 56 of the guests toured the new Vickers Administrative and Engineering Center in suburban Detroit.

Improved maintenance of existing aircraft hydraulic equipment was one subject discussed extensively in the two-day meeting. A. R. Civitate of Vickers talked on "How Service Experience Can Help Make Better Hydraulic Systems." F. H. Langenfeld of Monsanto Chemical Company presented a paper on "Ideal Hydraulic Fluid Specifications

W. L. Cisler, *left*, Fellow ASME, president and director, The Detroit Edison Company; and C. F. Kettering, *center*, greet Rear Admiral H. G. Rickover, chief of the naval reactors branch of the AEC and luncheon speaker on the second day of the Seventh Edison Foundation Institute. His topic was "The Education of Our Talented Children."

stitute was held at Glenmont, the home of Thomas Alva Edison in West Orange, N. J., and the Hotel Suburban in East Orange, Nov. 19-20, 1956. The two-day conference was also addressed by Charles F. Kettering, Fellow ASME, president of the Edison Foundation; Sherrod E. Skinner, Fellow ASME, vice-president, General Motors Corporation; and Walker L. Cisler, Fellow ASME, president of the Detroit Edison Company, to mention just a few.

Admiral Rickover stated that, "For the past 50 years we have, in the name of educational democracy, tried to make one common school serve all children instead of finding the appropriate school for the two main groups of children—the majority who plan on non-academic careers, and the minority who plan for college and university. We must reverse this unfortunate trend in American education."

Model Schools

He suggested that industry, together with educational foundations, undertake the setting up of model academic secondary schools in 25 different centers in the United States. These schools would be on a par with the best secondary schools. They would be free; the ability to pass an entrance examination of a kind which would weed out those not mentally capable of absorbing an academic secondary education would be the only requirement. He said these schools would be staffed by teachers truly capable of teaching talented children; teachers whose qualifications place less emphasis on training in teaching methods and more on graduate study in their fields.

"Teachers' salaries in these schools would be in accord with the high scholastic qualifications required and, therefore, equal to those paid for comparable positions in industry," he said and described further: "These model schools should aim at a ratio of at least one teacher for every 20 pupils (and) would start with the fifth grade so as to have the pupils ready for college at 16."

"We must find a way for our children to attend school for more than the present 180 days. Lengthening the time in school might most easily be done through the medium of voluntary summer courses."

He estimated that the cost of operating each model school for a period of five years will be about $10 million. At the end of that period the community ought to have an option to take over the school, provided it agrees to continue the high scholastic standards set under private management.

"We must not forget that well-to-do parents always have it in their power to assure their children a good education by sending them to private preparatory schools. But the talented poor child must depend solely on the public school. Education in a democracy must not only be democratic, it must also be education."

Trained Manpower a Weapon

Admiral Rickover said that these educational reforms are especially needed because of the critical shortage of scientists and engineers in the United States. "Trained manpower has become a weapon," he declared, "in this cold war it determines how much technical aid each side can offer. Russia will soon have a surplus of trained manpower which she can export. We have a shortage. Can we allow Russia to outdo us in aiding the neutrals? Can we let her become Big Brother to all the backward countries of the world?"

"No matter what methods are chosen in the duel between the communist and the free world, education will, in the final analysis, determine the outcome, particularly the education of talented youth. . . ."

"Our social mores are hostile to the concept that children of superior mentality ought to receive special consideration at tax-supported schools. The very thought of recognizing differences in intellectual ability is repugnant to our equalitarian philosophy."

". . . We are committed to the basic assumption that there is no person who can claim to be an indispensable man. We proceed from this entirely correct assumption to the incorrect conclusion that neither does a democracy have indispensable men. This is obviously erroneous . . . no society can function without its indispensable men."

J. R. Dunning, *left*, dean of Columbia University School of Engineering, first-day luncheon speaker at the Seventh Thomas A. Edison Foundation Institute, welcomed to the Institute by C. F. Kettering, *center*, president, Edison Foundation, as G. R. Cowing, Mem. ASME, president, General Motors Institute, looks on

in many ways, particularly for easier transportability. Production of titanium sponge at du Pont and wrought titanium and titanium alloys at Remington Arms, now Rem-Cru, began only eight years ago. Wrought products shipped in 1948 totaling $2^1/_2$ tons, were just under 2000 tons in 1955, and the industry will ship over 5000 tons of sheet, bar, billets, and forgings this year.

By using titanium and its alloys to replace steel, Pratt & Whitney's J-57 jet engine, used on five military types, and, in the JT-3 and JT-4 commercial modifications, on America's first two jet-passenger transports, weighs in with many less pounds and still delivers more than 10,000-lb thrust. Orenda Engine's Iroquois is reported to deliver a static thrust of 20,000 lb, and with the exception of the shafts, the stages of the Iroquois forward of the combustion system will be made completely of titanium. As much as several hundred pounds flying weight of titanium have been engineered into the structure of some planes.

Many of the "awkwardnesses" which arose as a result of accelerated research have been corrected. Vacuum annealing furnaces can restore the properties lost when hydrogen is accidentally high; delayed cracking is no longer a problem; commercial titanium and several alloys of the all alpha-type can be successfully welded.

Thus far only arc melting in a cold copper crucible in an inert atmosphere has proved practical; refractories are still a problem. Mechanical reduction, rolling, and so forth are major problems and titanium may require newly designed equipment differing from that for conventional metals. Ample supplies of titanium, the fourth most abundant element, are available on this continent. In many cases, it is the most economical metal on the basis of replacement costs alone, and although per pound costs appear high, the cost per service year is often lowest when titanium is used. The price per pound of titanium sheet is 17 times greater than that for type 316 stainless, and the price per square foot about nine times, but the cost of finished equipment employing titanium is roughly only two or three times as great. "Therefore, where a reactor, heat exchanger, or autoclave lined with titanium will outlast other materials by a factor of three, the titanium equipment will be the choice, even discounting the expenses of downtime."

Forging Steels

Sophisticated research on the fundamentals of forging steels, particularly on the transverse reduction area in tensile testing, indicated that that test could be used as a valid analysis of steel quality for rejecting defective forgings and for the improvement of steel quality. "Inadequate transverse ductility" is also pertinent to failures in aircraft landing gears. "The constant urge to reduce the weight of aircraft and conserve space has led to engineering studies, laboratory investigations, and limited application of steel forgings, heat-treated to an ultimate strength of 230,000 to 280,000 psi."

Much more knowledge is required of toughness and especially of progressive stress damage, and the lack of a generalized and useful theory of practice is felt. Investigations have been made of the effect of alloying elements, chromium, nickel, molybdenum, and silicon, on the relationship between ductility and tempering temperatures, and the role of retained austenite in quenched and tempered steels. Recent studies on the addition of rare earth elements, mixtures of cerium lanthanum and others, have shown the addition to be of undoubted value in castings, and appear to show that poor quality forging steels may be up-graded.

Advances in the method for magnetic particle and ultrasonic inspection methods permit a more rigorous selection of product. The linear accelerator, electron microscope, and radiographic examination of castings and weldments are useful research and inspection aids.

The Army's Rodman Laboratory investigates such processes as vacuum melting, investment casting, and extrusion; and the ceramic tool bit for the high-speed cutting of alloy steel, announced about a year ago, was developed there.

The Naval Research Laboratory has recently produced a new catch phrase—notch toughness. This new parameter in describing the physical characteristics of steel is a measure of the steel's ability to resist almost instantaneous brittle crack propagation. "All steels have a temperature at which they will fail in a completely brittle fashion, shattering like glass without any plastic deformation. It has been found that this temperature, known as the nil ductility transition temperature, has existed well above 100 F in some structural steels and a vast tonnage tested shows the transition temperature of 40 to 70 F. This means that many of our structures—bridges and ships—could be subject to brittle fractures at normal service temperatures.

During the second world war many merchant-type ships suffered serious cracking of the hull structure, indeed some broke entirely in two. There are several methods of measuring the transition temperature, the Charpy V-notch specimen, the explosion bulge, and the drop weight. They will all produce data which will allow us to predict accurately how a steel will behave under stress at a given temperature.

"The strength-ductility relationship of a medium carbon (0.25) high silicon 1.5 to 2 per cent quenched and tempered to 500-550 F is satisfactory, but the standard forging steel 4340H tempered at 400 F is equally satisfactory. Neither appears to be the answer for the next step, 280,000-320,000 psi."

Oil or Uranium—World Energy Resource of the Future

"The present Middle East crisis is one aspect of the growing struggle for control of world energy resources," John R. Dunning, Mem. ASME, dean of the Columbia University School of Engineering, told alumni at Engineering Dean's Day luncheon, December 1, at the Men's Faculty Club.

Addressing the group on "You and the Peaceful Atom," Dean Dunning said that "energy, which is the key to productivity, is being increasingly sought after by various countries in order to raise their living standards.

"The Middle East represents one area in which lie not only energy resources in the form of oil, but also the control of the flow of that energy through the Suez Canal.

"However, I believe the pattern of quest for energy is changing and more and more will be directed toward uranium, presently our chief source of nuclear energy. In the future the pattern may change so much, that the oil in the Middle East won't matter.

"As the world's demand for energy increases, it will influence not only engineers and machines, but political and economic thought as well, for atomic energy will supply a great part of the enormous amount of useful power for succeeding larger generations.

"As a matter of fact," he continued, "if we do not take steps now to vastly increase the number of people in our technological fields, we will not be ready for the population explosion the world is experiencing, which, if we are not prepared, could be more dangerous than the hydrogen bomb explosions."

The Columbia dean, a pioneer atomic physicist, spoke of the widening areas of education for the atom, where the consideration of nuclear energy and its by-products cross the borders of physics, chemistry, chemical and mechanical engineering, and many other accepted disciplines. "Like industry itself," he said, "our science and engineering education is feeling the pervasive power of nuclear energy, which is beginning to turn up in ever-widening spots in our educational pattern, just as in diverse plants of industry."

Pointing out that more than 200 students in science and engineering at Columbia University are involved in nuclear engineering, Dean Dunning said that, "As energy from the atom becomes cheaper and more available for wider use, a revolution in our educational system must inevitably take place. The present status of science and technology as we know it, including the rate of basic discovery and wide application, if projected into the future, could not begin to take care of the world.

"We need, along with the growth of the peaceful use of atomic energy, an equally wide growth in knowledge, in men's ability to absorb that knowledge and in the number of persons with ability to produce. Only when we begin to realize the tremendous task and responsibility our grandsons will have, will we be able to put our educational house in order with the proper emphasis on brainpower and technology to make it possible for future generations to achieve the best life," he concluded.

View of the 1956 Vickers Transport Aircraft Hydraulic Conference holding session

for the New Transports." W. W. McKenzie, Canadair Ltd., presented one on the "Hydraulic System of the Canadair CL-28 Maritime Reconnaissance Aircraft." F. Moncher of Vickers discussed "New Trends in Aircraft Hydraulic Components and Systems."

Mr. Moncher, chief engineer, aircraft products division, Detroit, discussed improvements being made on existing products and the development progress leading to new components and systems for the aircraft ma[illegible] those mentioned were a jet en[illegible]arter, in-flight fuel-transfer equ[illegible]ent, jet engine-control packages, and dynamic test stands for jet engine-fuel controls.

Mr. McKenzie's paper gave details of the main and emergency hydraulic systems for main and nose landing gear, main wheel brakes, nose-wheel steering and control surface locking for the new CL-28. He made an interesting comparison between the 3000-psi system used on the CL-28 and the 4000-psi system in the Britannia.

Mr. Langenfeld set up 15 requirements for an ideal hydraulic fluid, then explained what their chemists were doing to achieve it.

Mr. Civitate stressed the importance Vickers, Inc., places on service, and pointed out that one of the most effective routes to upgrading products is through good technical service. Technical service provides Vickers with the information needed to make practical and desirable improvements.

The tour of the Engineering and Administrative Center was conducted Thursday morning, November 15. Guests were given a close look at the elaborate laboratory activities in connection with the development and testing of hydraulic components. Of particular interest were servosystems, the thermal shock facilities and the electronic analogue computer.

New Developments in Metallurgy Topic of American Ordnance Association Meeting

"Superalloys," titanium and titanium alloys, and forging steels discussed

From the broad field of new metallic materials that have assumed importance, three items were chosen for exploration and discussion by a panel on "New Developments in Metallurgy," at the Thirty-eighth Annual Preparedness Meeting of the American Ordnance Association, held at the Waldorf-Astoria Hotel, New York, N. Y., on Dec. 5, 1956.

Participants in the panel led by Robert Mehl, head of the department of metallurgy, Carnegie Institute of Technology, were: Benjamin S. Mesick, Mem. ASME, Col. USA (ret.) and manager of the Los Angeles office of Arthur D. Little, Inc.; Comdr. Frank G. Scarborough, USN, head of the Welding, Casting, and Metal Fabrication Branch, Bureau of Ships; and John B. Johnson, chief scientist, Aeronautical Research Laboratory, Wright-Patterson Air Force Base, Ohio.

Dr. Mehl stated that the items chosen were (*a*) "superalloys" for use at very high temperatures, an example of a relatively new field of application; (*b*) titanium and titanium alloys, an example of the new metals that are coming into use; and (*c*) forging steels, an example of new applications and new knowledge of an old material.

Superalloys

Most superalloys developed in the past 15 years have been for use in the 1200–1700 F range, and in recent years even higher. Oversimplified, the general requirements are: high-temperature strength, ductility, toughness, and resistance to deterioration in the ambient atmosphere, with special requirements for some uses.

With the possible exception of molybdenum, all such materials are complex alloys of as many as eight elements divided into two main classes, cobalt-base and nickel-base, with an astronomical number of possible combinations. It is impossible to treat them in the scientific way used for alloys of two or three metals—"there aren't enough dimensions in space to represent the phase diagrams of the systems involved!"

Metallurgical principles developed in simpler systems such as solid-solution hardening, dispersion hardening, and precipitation hardening can be applied in a qualitative sense, but there is great need for further fundamental studies. Thus, these complex alloys are steadily improved, chiefly by changes in composition and by improved processing procedures, but a major break-through in research would be desirable so that such materials might be used up to as high as 3000 F. Molybdenum, with additives of niobium, titanium, or vanadium provides a useful strength above 1600 F greater than that of any other commercially available material; but needs protective coating against oxidation. The relatively new element—niobium, formerly called columbium, no longer in short supply, possesses a melting point of 4380 F with interesting possibilities and is being studied by a dozen laboratories.

One composition developed by the Navy Bureau of Ordnance known commercially as Orthonol has optimum characteristics of high permeability, but contains 50–65 per cent nickel, a critical material. A substitute series, known as Alfenol, contains only Al and Fe, but is somewhat inferior. Alfenol alloyed with 4 per cent molybdenum raises the upper operating temperature several hundred degrees and is called Thermonol. Development and evaluation are still in process, but one potential use is in grid applications. Its major defect is low ductility on which improvement is being made.

Titanium and Titanium Alloys

Few of the metallurgical advances have attracted as much interest as the development of titanium and titanium alloys. High-melting point, high-temperature strength, resistance to corrosion and oxidation, and a favorable strength-weight ratio are of importance

and an authority on the highway development program.

"The Engineer and the American Economy" is the title of the Thursday luncheon address by Prof. John Bell Rae of Case Institute of Technology. This will be followed in the afternoon by a panel analysis of the salary structure of engineers. Latest available data on professional income of engineers and the principal methods of salary administration will be presented.

The EJC Assembly Dinner on Thursday evening will have as principal speaker Henry T. Heald, Mem. ASME, President of the Ford Foundation.

The relations of the engineer to the international scene and his vital role in the maintenance of the balance of technological power in the world will be presented by the Friday panel. At the concluding luncheon, the Assembly will hear W. A. B. Illiff, vice-president, International Bank for Reconstruction and Development, talk on "Overseas Development, Engineers, and the World Bank."

Engineers Joint Council is a federation of twelve national societies of which The American Society of Mechanical Engineers is one and two regional engineering societies representing over 220,000 members.

O. B. Schier, 2nd, Appointed Deputy Secretary of ASME

During the 1956 Annual Meeting of The American Society of Mechanical Engineers, O. B. Schier, 2nd, was appointed deputy secretary of the Society.

Mr. Schier has been a member of the ASME Secretary's staff since June, 1946, and his activities with the Society, particularly in connection with the Publications Committee and the Metropolitan Section, date back to the early 1930's.

A native of Baltimore, Md., he received his early education at the Baltimore Polytechnic Institute. In 1929, he was graduated from Lehigh University with the degree of ME, and he received the degree of MS from the same institution in 1931. From 1931 to 1937 he served with the Brooklyn Edison Company as junior engineer, cadet engineer, assistant inventory supervisor, and assistant engineer; and from 1937 to 1941, with the Consolidated Edison Company of New York, Inc., as assistant engineer.

In 1941, Mr. Schier became associated with the War Production Board, Production Service Division, New York, N. Y. As a member of the U. S. Naval Reserve, he was attached to the Industry Co-Operation Division, Office of Procurement and Material, Chicago, Ill., from 1943 until his discharge, with the rank of lieutenant in 1946.

Mr. Schier became a Junior Member of ASME in 1932 and was transferred to the grade of Member in 1940. He served the ASME Metropolitan Section as chairman of the Junior Group from 1932 to 1936, and as secretary and member of the Executive Committee of the Section from 1936 to 1940. In 1934, he became an advisory member of the Publications Committee and later was a regular member of the Committee. He was also a member of the Junior Committee of the Committee on Professional Training, Engineers' Council for Professional Development.

As a member of the ASME staff Mr. Schier first served as secretary to the Professional Divisions. In 1948 he became Meetings Manager and took over the task of organizing and operating national meetings and divisional conferences. In 1953 he was assigned additional duties and as Field Manager served the eight vice-presidents in their regional responsibilities particularly in Section and Student Section operations, Membership Development, and Admissions.

In November, 1953, Mr. Schier was appointed Assistant Secretary and in January, 1956, was placed in charge of Field Service where he continues to serve the vice-presidents and in addition serves the Board on Membership, Board on Public Affairs, Board on Honors, Civic Affairs Committee, National Junior Committee, Engineers Registration Committee, Committee for Professional Practice of Consulting Engineering, and the Old Guard Committee of the Society; Engineers Joint Council, and the Engineering Societies Personnel Service, Inc.; and performs other duties assigned by the Secretary.

W. F. Ryan, *left*, President, ASME, reviews his program for 1957 with O. B. Schier, 2nd, recently appointed deputy secretary of ASME

ASME Coming Events

March 10–15
Nuclear Congress, Convention Hall, Philadelphia, Pa.
(Final date for submitting paper was Nov. 1, 1956)

March 18–21
ASME Gas Turbine Power Conference, Hotel Sheraton Cadillac, Detroit, Mich.
(Final date for submitting papers was Nov. 1, 1956)

March 27–28
ASME Engineering Management Conference, Hotel William Penn, Pittsburgh, Pa.
(Final date for submitting papers was Nov. 1, 1956)

April 8–10
ASME Spring Meeting, Hotel Dinkler Tutwiler, Birmingham, Ala.
(Final date for submitting papers was Dec. 1, 1956)

April 8–10
ASME Instruments and Regulators Conference, Northwestern University, Chicago, Ill.
(Final date for submitting papers was Dec. 1, 1956)

April 25–26
ASME Railroad Conference, Hotel Sheraton, Chicago, Ill.
(Final date for submitting papers was Dec. 1, 1956)

April 25–26
ASME-SAM Management Conference, Hotel Statler, New York, N. Y.
(Final date for submitting papers was Dec. 1, 1956)

May 16–17
ASME Wood Industries Conference, Winston-Salem, N. C.
(Final date for submitting papers was Jan. 1, 1957)

May 19–23
ASME Oil & Gas Power Conference, Kentucky Hotel, Louisville, Ky.
(Final date for submitting papers was Jan. 1, 1957)

(Continued on next page)

ASME News

With Notes on Society Activities and Events

E. S. Newman, *News Editor*

ASME Joins Other Societies Planning 1957 Nuclear Congress

Congress and Exposition to be held in Convention Hall, Philadelphia, Pa.

PEACETIME uses of atomic energy will be the topic of the 1957 Nuclear Congress, scheduled for March 11-15 at Philadelphia's Convention Hall, under the co-ordination of Engineers Joint Council. The session will bring together leaders in science, engineering, industry, government, education, agriculture, and other fields.

Included in the Congress are four major elements, including the Second Nuclear Engineering and Science Conference, co-ordinated by EJC on behalf of 20 engineering and scientific societies of which The American Society of Mechanical Engineers is one of the leaders. One-hundred-thirty technical papers will be presented during a four-day program.

The National Industrial Conference Board will hold its Fifth Conference on Atomic Energy in Industry, featuring 12 round-table discussions, a dinner on Thursday, March 14, and a luncheon meeting on March 15.

The International Atomic Exposition, sponsored by the American Institute of Chemical Engineers in co-operation with four other engineering societies, will display industry's latest items in the atomic field.

The Fifth Hot Laboratories and Equipment Conference, sponsored by the Hot Laboratories Committee of the Oak Ridge National Laboratory, Oak Ridge, Tenn., will take place on March 14 and 15 and deals with the operation and development of equipment for laboratories for atomic energy.

W. G. Whitman Is General Chairman

Walter G. Whitman of the Massachusetts Institute of Technology, president of the American Institute of Chemical Engineers and secretary-general of the United Nations "Atoms For Peace" Conference in Geneva, 1955, is general chairman for the 1957 Congress. According to Dr. Whitman, "The 1957 Nuclear Congress will continue the remarkable co-operation among engineers and scientists from almost every portion of the globe and from every branch of science and engineering for the benefit of mankind, that was first evidenced at Geneva and later at the first EJC Congress in Cleveland in 1955. Progress in the civilian uses of atomic energy is being immeasurably expedited through this co-operative action."

"The field of civilian atomic energy is growing fast," said Dr. Whitman, "but it is still very young. A basic problem is how to expedite the dissemination of information on new developments. Expositions like these help to make good use of the time of the few people we have with knowledge in this technical field," he concluded.

Commenting generally on the Congress, Thomas H. Chilton, Mem. ASME, EJC president, said that "the true value of the Congress does not lie in its sheer size. Its significance lies in the fact that there will be an opportunity to gather in one place at one time, representatives of all of the many arts and sciences that are concerned with the rapidly growing field of atomic energy.

"This will be an unparalleled demonstration of true unity of purpose and action, both within the engineering profession and within the larger field of science and technology. This program promises to be an outstanding one, both from the point of view of lasting contributions to peacetime uses of atomic energy and as a sterling example of interprofessional co-operation."

Program chairman for the 1957 Nuclear Congress is Bruce Prentice, Mem. ASME, of General Electric, member Executive Committee of ASME's Nuclear Engineering Division, and member of AIEE and ANS. T. A. Marshall, Jr., assistant secretary of ASME, is Congress manager; and Lewis R. Gaty, vice-president of the Philadelphia Electric Company is chairman of the Philadelphia arrangements committee.

John S. Sinclair, president, National Industrial Conference Board, notes that "never before have business men been able to attend three large integrated conferences and a trade fair on atomic energy within the same week. The EJC is to be congratulated for its efforts to eliminate unnecessary duplication of meetings in this field."

Attendance at the Nuclear Congress is expected to exceed the 3000 at the Cleveland Congress in December, 1955. The International Atomic Exposition, which drew 18,000 persons in Cleveland, expects many more interested observers at its displays in Convention Hall in March. The Exposition reports that it will be bigger and more diversified than before, with many firms exhibiting for the first time and with space reservations being made at a record rate. J. V. Friel, Exposition director, observes that reservations for the exhibitions are 20 per cent ahead of the 1955 Exposition, with three out of ten companies being new to the field.

Technical Papers

Presented at the Nuclear Engineering and Science Conference will be 130 technical papers dealing with various phases of nuclear operations from mining to the disposal of radioactive waste. Emphasis will be on new developments of potential value to civilian industry, especially in the fields of metallurgy, chemical processing, mechanical, and power application.

Topics which will be covered by the "Fifth Atomic Energy in Industry Conference" are fusion; recent developments in radiation chemistry and radioisotopes-applications; foreign and domestic markets for atomic energy products; nuclear propulsion; waste disposal; health and safety problems; the economics of new reactor types; the latest developments in atomic-energy legislation; site-selection problems for nuclear facilities; and problems in local and state atomic-energy regulations.

The 1957 Congress, already supported by 20 major United States engineering, scientific and management groups, also expects representatives from other nations to participate in various aspects of the meetings and to exhibit at the Exposition.

EJC General Assembly Announced for January 17-18

THE vital place of the engineers, nationally in defense, internationally on the technological "cold front," and what he should be paid in our expanding economy, are three paramount topics in the 1957 Engineers Joint Council General Assembly, January 17 and 18 at the Statler Hotel, New York, N. Y.

The two-day annual meeting will hear Major General J. B. Madaris and Dr. Werner von Braun of the United States Army Ballistic Missile Agency as well as a senior representative of the U. S. Civil Service Commission

Junior Forum

Conducted for the National Junior Committee

by R. A. Cederberg,[1] Assoc. Mem. ASME

Dr. J. W. Barker, outgoing ASME President, discusses professional attitudes at the Junior Session during the 1956 ASME Annual Meeting. At the speaker's table, *left to right,* are D. E. Jahncke, first chairman, National Junior Committee; Joseph Schmerler, 1956 chairman, National Junior Committee; Dr. Barker; and R. K. Bryant, vice-chairman of session.

Report on Junior Session at the 1956 ASME Annual Meeting

By R. K. Bryant[2] and H. N. Weinberg[3]

The second day of the 1956 ASME Annual Meeting was a pleasant and stimulating one for the Associate Membership.

A vigorous message from ASME President Barker highlighted the day during which two formal sessions were held under the joint auspices of the Education Division and the National Junior Committee. An informal get-together of the Associates for cocktails and dinner was followed by an Executive Session of the National Junior Committee.

Guy R. Cowing, Mem. ASME, president and director of the General Motors Institute, was the main speaker at the morning session. His thorough analysis and dry-humored presentation of the topic, "Distinguishing Characteristics of the Mechanical Engineer," provoked much thoughtful discussion.

What Is an Engineer?

Mr Cowing acknowledged the difficulties involved in trying to define the term "engineer." However, his approach to the problem was to begin with the preparation the mechanical engineer receives in his undergraduate curriculums. He recalled that the American Society of Engineering Education has suggested that all engineering sciences can be divided into several basic categories which cover all physical phenomena and that mechanical-engineering curriculums include more of these categories than do the other engineering curriculums. "Therefore, one of the distinguishing characteristics of the mechanical engineer is the breadth of his foundation in the engineering sciences."

Second, Mr. Cowing felt that the "mechanical engineer professionally is characterized by the variety of his interests and specialties." The range of fields covered by the ASME Professional Divisions and the extensive and varied program for the Annual Meeting were cited as examples of the mechanical engineer's wide interests and accomplishments.

In line with these first two characteristics, the mechanical engineer's other advantages were considered to be ready acceptance of him by industry for a great variety of assignments, his awareness and grasp of the other engineering fields, and the mechanical engineer's consistent ability to communicate with other engineers as well as management and nonprofessional personnel.

In the discussion which followed, Mr. Cowing went one step further to make the point that he felt the mechanical engineer most nearly approached the concept of the general engineer.

It appeared to be the consensus among those who participated in the discussion that a man who is well grounded in the engineering sciences by virtue of his educational background and immediate postgraduate training was exceptionally valuable to industry. Such a man, because of his broad background, is able to attack his day-to-day problems in the most expeditious manner and, when required, he is able to dig beyond the surface and concentrate his efforts. Thus he combines diversification with optimum specialization making his education a continuous and rewarding process.

Attitudes Cultivated in Class

There were other interesting comments from the floor such as the questions which resulted in the general statement "that engineering professors don't just teach basic scientific facts but they do impart, for better or worse, the basic attitudes and feelings towards industry, fellow employees, and the community which the young engineer carries with him." Therefore, it is imperative that a conscientious effort be made by these educators to transmit proper attitudes and feelings which will contribute to a well-rounded engineering personality.

The afternoon session was conducted by Joseph Schmerler, Chairman of the National Junior Committee. To familiarize those present with the National Junior Committee, D. E. Jahncke, its first Chairman, briefly outlined the Committee's history.

National Junior Committee

The Committee was formed in 1947 as a means of offsetting an unfortunate situation existing in the Society with regard to the Associate Members. Neither the Society nor the Associates were receiving many of the potentially significant benefits from Associate Membership. To the Associate, the Society appeared large, impersonal, and stodgy and they were therefore apathetic toward it. Since the inception of the National Junior Committee there has been a closer relationship between the Society and the Associate Membership. According to Mr. Jahncke, specific results of the National Junior Committee's actions are typified by the following accomplishments.

(a) Junior groups have been established within the larger local sections and in the other sections Associates have been accepted as members of the Executive Committee. This has resulted in improved attendance at Section meetings and in general a better understanding between the Members and Associates.

(b) The Junior Forum was established as a regular feature in Mechanical Engineering and has become a means by which the Associates can express themselves and present their views on nontechnical subjects.

(c) Junior Sessions have become an accepted part of the program at all regional and national meetings. The Old Guard particularly has

[1] Remington Rand Univac, St. Paul, Minn.

[2] Material Procurement Engineer, Esso Engineering Division, Standard Oil Company of N. J., Linden, N. J. Assoc. Mem. ASME.

[3] Mechanical Engineer, Esso Research and Engineering Company, Linden, N. J. Assoc. Mem. ASME.

May 20–23
ASME Design Engineering Conference, Coliseum, New York, N. Y.
(Final date for submitting papers was Jan. 1, 1957)

June 9–13
ASME Semi-Annual Meeting, Sheraton-Palace Hotel, San Francisco, Calif.
(Final date for submitting papers—Feb. 1, 1957)

June 13–15
ASME Applied Mechanics Conference, University of California, Berkeley, Calif.
(Final date for submitting papers—Feb. 1, 1957)

August 11–15
ASME Heat Transfer Conference, Pennsylvania State University, University Park, Pa.
(Final date for submitting papers—April 1, 1957)

Sept. 9–13
ASME IRD-ISA Conference, Auditorium, Cleveland, Ohio
(Final date for submitting papers—May 1, 1957)

Sept. 22–25
ASME Petroleum Mechanical Engineering Conference, Hotel Mayo, Tulsa, Okla.
(Final date for submitting papers—May 1, 1957)

Sept. 23–25
ASME Fall Meeting, Hotel Statler, Hartford, Conn.
(Final date for submitting papers—May 1, 1957)

Oct. 7–9
ASLE-ASME Lubrication Conference, concurrently with ASME-IMechE International Conference on Lubrication and Wear, Royal York Hotel, Toronto, Ont., Canada
(Final date for submitting papers—June 1, 1957)

Oct. 8–12
ASME-AIME Fuels Conference, Chauteau Frontenac, Quebec, Que., Can.
(Final date for submitting papers—June 1, 1957)

Dec. 1–6
ASME Annual Meeting, Hotel Statler, New York, N. Y.
(Final date for submitting papers—July 1, 1957)
(For Meetings of Other Societies, see page 101)

ASME Southern California Section Cosponsors Intersociety Management Banquet

THE first Intersociety Management Banquet was held by the Management Division of the Southern California Section of The American Society of Mechanical Engineers on Nov. 20, 1956, in the Pacific Ballroom of the Hotel Statler, Los Angeles, Calif. Invited cosponsors of the event were the Los Angeles Section Management Division of the American Institute of Electrical Engineers and the Los Angeles Section Professional Group on Engineering Management of the Institute of Radio Engineers.

More than 400 executives of Los Angeles industry were given the high lights of "Manager Development at General Electric" by Marc A. deFerranti, Mem. ASME, manager of the Manager Development Consulting Service of the General Electric Company at Crotonville, N. Y. Mr. deFerranti told the group that the practical and realistic objectives of the manager development program are four: "(1) To provide all managers and potential managers in General Electric with challenges and opportunities for maximum self-development on their present jobs and for advancement as earned; (2) To work toward improving skill and competence throughout the entire manager group so as to help General Electric managers become equal to the demands of tomorrow's management job; (3) To operate to furnish the company with both the number and kind of managers which will be needed in the years ahead; and (4) To encourage systematic habits and procedures to make it simpler for each manager to discharge his manager-development responsibility."

Mr. deFerranti continued, "Manager development requires action in four major areas. The managerial climate of the organization component is created by the manager, his attitudes and behavior, his policies and practices, by the communication between himself and those whose work he manages, and by the standards for such climate which he sets. Self-development planning is personal, and it is direct, for every manager is responsible, first, for his own self-development, and second, for providing both opportunities and challenges to all men whose work he manages. Manager manpower planning is divided into three phases: First, long-range planning, which looks ahead at least five years to determine the size and kind of organization which will be needed to cope with the conditions and achieve the objectives of that time; second, short-range planning, which focuses on the specific needs of the next eighteen months to provide for orderly filling of vacancies and for proper promotion and placement of men; and third, planning for continuity of managerial leadership in order to assure the life and continuity of the enterprise itself. Manager education deals with four techniques of education: First, individual reading and study plans are the basic concepts of manager development as primarily a process in adult education, where the developing of skills and understanding for an adult is a matter of personal effort and individual initiative; second, is the installation of professional business management courses in an increasing number of our plant and office locations; third, is concerned with outside management courses and activities, wherein the company encourages its people to devote a fair share of their time to professional activities outside the sphere of their normal responsibilities both because such work is a needed contribution on the part of every responsible member of a free society, and because the infusion of new knowledge into the company is always necessary and valuable; and fourth, is the uninterrupted 13-week period of concentrated study covering the internal and external environment of the company, the principles of organization, and the work of managing as a profession given in the advanced management course at Crotonville, New York." After summarizing their manager development approach into nine principles, Mr. deFerranti concluded that "All of us can become *professional managers* and, indeed, if we would continue to manage, we have no alternative."

With so many distinguished leaders of industry in the audience, the head table was set to include only the speaker and the Section and Division top officers sponsoring the Banquet, *left to right,* R. P. O'Brien, Chairman, Management Division, AIEE; V. J. Braun, Chairman, Los Angeles Section, IRE; O. H. Jacobson, Banquet Chairman and Director, Management Division, ASME; M. A. deFerranti, speaker; P. L. Savage, Toastmaster and Chairman, Los Angeles Section, AIEE; M. Horrell, Chairman, PGEM, IRE; and F. J. Fontana, Chairman, So. Calif. Section, ASME

become interested in the Associates and has even gone so far as to provide financial assistance for various groups of Associates to attend national meetings held within their locale.

(*d*) Associates are now appointed as Junior Advisor Members to all of the Society's regional committees and to some of the national committees so that they may present the younger man's point of view, and at the same time take an active part in the actual operation of the Society.

Dr. Barker Discusses Professional Attitude

Dr. Barker, in his extensive travels as President of the Society, has been asked certain questions consistently which he felt were of related importance to the development of a professional attitude in young engineers. Therefore, he based his talk on these questions. His answers to them were presented in the nature of a challenge, not only to those present, but to the profession and to industry. Here are the questions with the answers which he presented.

"Are our engineering colleges, which are faced with considerable deterioration in the quality of the preparation of entering freshmen and are limited by a four-year program, still able to maintain the quality and depth of training which is the hallmark of engineering?"

Dr. Barker felt that the basic training was not as sound as it might be and that this is a real problem which must be faced immediately by educators, industry, and all engineers together.

"Have the demands of industry for 'graduate' trained engineers increased because of the recent great technological advances? Additionally, the question arises as to whether the engineer can maintain his professional position without extensive or at least some individual study."

Dr. Barker felt, as did Mr. Cowing, that the engineer's education must be continuous and broadening and requires conscientious effort on the part of the individual if he is to maintain his engineering status.

Then Dr. Barker proposed the question, "Whether the size,' tendency toward organization charts,' 'teamwork,' and the apparent national drive for 'security' have tended to rob engineers of (*a*) individual drive or initiative, (*b*) pride of individual achievement, and (*c*) feeling of professional responsibility?"

Dr. Barker's answer was that, thus far, this is generally not the case. However, he felt strongly that there is a lurking danger which both industry and the engineer together must be wary of and take appropriate measures to constrain.

Dr. Barker Asks a Few Questions

A group of important questions which Dr. Barker then posed were, "Whether the increase in size of engineering staffs had not contributed to 'lock-step' promotion and hence a diminution of individual creative drive; whether the present 'starting salaries' have compressed the salary differentials for the higher technical responsibilities and thus robbed 'achievement' of its recompense in salary; and whether these tendencies have contributed to a general lowering of professional attitude and created a tendency to unionism and collective bargaining as the means towards securing salary increases?"

Dr. Barker's emphatic reply was that there are far too many cases of men who love their jobs, find them challenging and satisfying, have a feeling of responsibility to their employer and to civilization, are productive and creative but nonetheless, salarywise and promotionwise, they are not being afforded adequate recognition by management. And in some cases management was trying to substitute only titles for the wherewithal to buy baby's shoes. It was his belief that the young men, as exemplified by the National Junior Committee, were doing their best to combat degrading attitudes which would affect the spirit of professionalism, but in this particular problem, it is far more important for the senior Members—the "industrialists"—to personally seize the initiative and provide equitable remedies. Otherwise, he felt, the consequences will be unhappy for all concerned.

At the conclusion of Dr. Barker's talk, there was considerable favorable comment from many of the recognized leaders of the Society who were in attendance as well as from some of the younger members.

The National Junior Committee feels that its efforts toward an interesting program for the Associate Members was notably successful.

Two Committees Activated by ASME Council

The Organization Committee of The American Society of Mechanical Engineers, on September 6, approved the recommendation of the Board on Technology that two committees be established. They are: ASME Solar Energy Application Committee to stimulate and develop a continuing program of Society activity dealing with the applications of solar energy, and a Technical Development Committee whose duties shall be to promote the development of technical activities in the Society by (*a*) continuous surveillance of growth of scientific and engineering knowledge; (*b*) anticipation of the needs of technical society activity in new fields of work; and (*c*) recommending, when deemed proper, the formation of new group activity within ASME to serve the Society's needs in new fields of work.

The Council approved the following nominees to make up the initial committees:

Solar Application Committee—J. I. Yellott, *chairman;* E. A. Allcut, L. J. Briggs, E. A. Farber, H. C. Hottel, R. C. Jordan, and W. T. Reid.

Technical Development Committee—J. W. Barker, *chairman;* R. C. Allen, A. D. Bailey, E. G. Bailey, H. L. Dryden, J. A. Hutcheson, C. F. Kettering, W. E. Reaser, L. N. Rowley, Jr., Philip Sporn, G. B. Warren, C. E. Williams, and J. I. Yellott.

Apply for Freeman Fellowship for Study or Research in Hydraulics

Qualified members of the American Society of Civil Engineers or The American Society of Mechanical Engineers, who have a worthy research program in hydraulics or related fields, may apply for Fellowship support to the Freeman Award Committee of ASCE in an amount not exceeding $3000, depending on the need claimed in the application.

ASCE and ASME are each administrators of a Freeman Fund. The Freeman Award Committees make awards through these Societies in alternate years (through the ASCE Committee in 1957). The conditions under which Fellowship applications will be studied are the following:

1 Each applicant must submit a study or a research program covering a period of at least nine months starting in 1957. Each shall include a statement of the funds needed from the Fellowship.

2 Each applicant shall furnish evidence of his qualifications to carry out the proposed program.

3 Applicants must be citizens of the United States and members in some grade of either of the two co-operating Societies.

4 Applications must be submitted to the Freeman Award Committee, c/o Secretary,

Nominations for ASME Honors Sought

Members and agencies of The American Society of Mechanical Engineers including Boards, Committees, Sections, and Professional Divisions are invited to submit nominations for Society honors and awards as described in the ASME Honors Manual MS-71. Nominations for 1957 must be in the hands of the Board on Honors prior to March 1, 1957.

As important changes have been made in the nominating procedures and the Manual it is *essential* that those wishing to make a nomination secure a copy of the Honors Manual dated October, 1956, by writing to the Board on Honors, ASME, 29 West 39th Street, New York 18, N. Y. Please note carefully information given on *pages* 3, 6, 9, 10, 11 12, and Appendix I for the major changes adopted by the Council in 1956.

American Society of Civil Engineers, 33 West 39th Street, New York 18, N. Y., by March 1, 1957.

5 Announcement of the Award will be made on April 15, 1957.

6 A report in English must be made by the awardee within 60 days after completion of his project.

7 The income from the Fund is to be used in the aid and encouragement of young engineers, especially in research work for:

(*a*) Grants toward expenses for experiments, observations, and compilations to discover new and accurate data that will be useful in engineering.

(*b*) Underwriting fully or in part some of the loss that may be sustained in the publication of meritorious books, papers, or translations pertaining to hydraulic science and art which might, except for some such assistance, remain mostly inaccessible.

(*c*) A prize for the most useful paper relating to the science or art of hydraulic construction.

(*d*) A traveling scholarship, open to members younger than 45 years, in any grade of membership, in recognition of achievement or promise; and for the purpose of aiding the candidate to visit engineering works in the United States or any other part of the world where there is good prospect of obtaining information useful to engineers.

(*e*) Assisting in the translation, or publication in English of papers or books in foreign languages pertaining to hydraulics.

1956 Annual Meeting of the Woman's Auxiliary—Full Week of Gala Events

Mrs. U. Amel Rothermel Elected New President

Reported by Mrs. J. C. Gibb

THE Woman's Auxiliary to The American Society of Mechanical Engineers held its 33rd Annual Meeting in New York, N. Y., November 25 through November 30, 1956. Four-hundred-and-forty-one women from all over the country registered in the Pennsylvania Room of the Statler Hotel. Eleven new members-at-large joined the Auxiliary, and others joined Sections, thereby raising the total membership to over 1500. The Auxiliary now has 21 sections, the newest being Kansas City.

Metropolitan Section, Hostess

The Metropolitan Section was hostess to the visiting ladies. Officers of the Annual Meeting Program were: Mrs. William E. Karg, Honorary Chairman; Mrs. John C. Gibb, General Chairman; Mrs. U. A. Rothermel, First Vice-Chairman; Mrs. William H. Byrne, Second Vice-Chairman; and Mrs. Erik Oberg, Chairman of the Metropolitan Section.

Early Bird Party

Repeated by popular request was the Sunday social event for ASME men and women, an Early Bird Party, held from 4:00 to 7:00 p.m. on Sunday, November 25, at the National Arts Club. More than 350 attended and were served punch and coffee as well as more substantial fare from the buffet tables. Accordian music contributed to the festivities, as did the piano playing of Benjamin W. Webb of Philadelphia, Pa., and A. F. Sperry of Skokie, Ill. It inspired many to participate in community singing. Co-chairmen of the Early Bird Party were Mrs. William H. Byrne and Mrs. Anderson Peeler.

Woman's Auxiliary Annual Meeting Committee paused just long enough for this photo before they took off for the Annual Luncheon at the Waldorf-Astoria Hotel. *Left to right,* Mrs. W. H. Byrne, 2nd vice-chairman in charge of the Annual Meeting; Mrs. U. Amel Rothermel, 1st vice-chairman in charge of the Annual Meeting; Mrs. W. E. Karg, honorary chairman of the Annual Meeting; Mrs. Erik Oberg, chairman of the Metropolitan (host) Section; and Mrs. J. C. Gibb, general chairman of the Annual Meeting.

Registration

Registration for women was held each morning of the Annual Meeting at 8:30 a.m. in the Pennsylvania Room. Mrs. Gordon Hahn, Mrs. F. S. Mallette, and Mrs. R. W. Oakley were registrars, and were kept busy welcoming and registering both members and nonmembers who paid a service charge of $1.

The Coffee Hours

On Monday and Tuesday mornings, coffee was served in the attractive Cornell Room of the Statler, providing a fine opportunity for old friends to meet and make new friends in a relaxed atmosphere. Dorothy Sara, president of the American Graphology Institute, provided much pleasure with her handwriting analyses during both these hours.

Co-chairmen for the Monday Coffee Hour were Mrs. Allan R. Cullimore and Mrs. Crosby Field. Co-chairmen of the Tuesday Coffee Hour were Mrs. Marie Michal and Mrs. J. W. Wilkenfelt.

Annual Tea Dance

The always-popular Tea Dance was held on Monday from 4:00 to 7:00 p.m. in the Georgian Room of the Hotel Statler and attracted about 400 persons. Jim Harkin's Orchestra provided danceable and enjoyable music for this attractive event. Officers from the National or Metropolitan Section greeted guests as they arrived. At the tea table, with its unusual arrangement of chrysanthemums, guests were served coffee or tea, sandwiches and petits fours, mints, and nuts. Co-chairmen of the Tea Dance were Mrs. H. R. Kessler and Mrs. U. A. Rothermel. Those who poured were: Mesdames Miller, Gagg, Bradley, Hahn, Purdy, Landis, Karg, Barker, Worley, Rothermel, Larkin, Friend, Goetzenberger, Oberg, Gibb, and Wetzel.

Night Club Tours

Under the expert guidance of Glass Dome Tours, 65 persons had a leisurely dinner in the spacious, beautiful Rainbow Room of the Rockefeller Center Building, and enjoyed its fine food and service, as well as the magnificent view of Manhattan at night. The group then went to the Chateau Madrid for its colorful and fast-paced floor show, which lasted almost an hour. After an interval of dancing to the Club's famous Latin rhythms, the next objective was the Village Barn, where the informal mood set by the comedians in the

The new officers of Woman's Auxiliary of the ASME seated, *left to right,* are Mrs. R. W. Worley, first vice-president; Mrs. U. Amel Rothermel, president; Mrs. R. L. Goetzenberger, second vice-president. Standing, *left to right,* are Mrs. T. S. McEwan, fourth vice-president; Mrs. Gordon Hahn, treasurer; Mrs. E. S. Bristol, corresponding secretary; and Mrs. W. S. Major, third vice-president.

View shows head table at the luncheon honoring past-presidents of the Woman's Auxiliary to the ASME held at the Fifth Avenue Hotel, New York, N. Y., November 28. Smiley Blanton, principal speaker, whose topic was "Love in a Changing World," is readily identified in the photo. He is the author of the current best seller, "Love or Perish." More than a hundred women attended this event.

humorous floor show was much enjoyed. Co-chairmen for the Night Club Tour were Mrs. E. J. Sharkey, Jr., and Mrs. Walter D. Temple, Jr., both assisted by their husbands.

President's Breakfast

Tuesday morning in the Dartmouth Room of the Hotel Statler the National Board held an informal buffet breakfast under the chairmanship of Mrs. W. H. Larkin and Mrs. T. R. Burdick, co-chairman, who was unable to be present because of the illness of her husband. A National Board Meeting, presided over by Mrs. William E. Karg, President, followed immediately. Mrs. Karg introduced the question of the need for visits by the Auxiliary President to the various Sections in order to establish and maintain better integration of the Sections with the National Board. Many ideas on how to finance such visits were presented; that of a revolving fund appeared the most popular. Members were asked to give the question more thought. Also discussed were numerous ideas advanced by the Section Chairman for raising money for the Scholarship Funds.

Sight-Seeing Tour of New York City

For those who did not attend the National Board Meeting, a sight-seeing tour of central and upper Manhattan and the Hudson River was arranged by Glass Dome Tours. Three buses left the Hotel Statler at 10:00 a.m. and took the ladies past many of the world-famous stores, private mansions and legations, Lever House, the Coliseum, The Hayden Planetarium, and Manhattanville. Stops were made at the Cathedral of St. John the Divine, the Frick Museum, and the Morgan Museum. The tour, which terminated at the Waldorf-Astoria Hotel in time for the Annual Luncheon, was under the Co-chairmanship of Mrs. Christian Bertelsen and Mrs. George A. Harman.

Annual Luncheon and Fashion Show

A record turnout of 305 women attended the Annual Luncheon and Fashion Show, held at 1:00 p.m. in the Empire Room of the Waldorf-Astoria Hotel. Mrs. Erik Oberg, Chairman of this beautiful affair, was assisted by Co-chairmen Mrs. Walter F. Friend and Mrs. John H. Hochuli.

The head table decorated by Mrs. Hochuli and Mrs. W. W. Clinedenst with Rothschild lilies, ivy, gourds, and geraniums was so effective that the Hotel asked if it could be left for use by another party at dinner! Stunning folders provided by Moore-McCormack Lines for the programs added much to the color of the individual tables, as did the silver and gold corsages provided for all the guests by the Metropolitan Section. Mrs. John C. Gibb, General Chairman of the Annual Meeting, presided. Honor guests on the dais were Mrs. Joseph W. Barker, wife of the retiring President of ASME, and Mrs. F. L. Bradley, sister of the incoming President of ASME, William F. Ryan. Others on the dais besides Mrs. Gibb, Mrs. Oberg, Mrs. Friend, Mrs. Hochuli, and Mrs. William H. Byrne, Second Vice-Chairman of the Annual Meeting, were the national officers of the Auxiliary, Mrs. Karg, Mrs. Rothermel, Mrs. Robert W. Worley, Mrs. Theodore A. Wetzel, Mrs. Arthur M. Gompf, and Mrs. William H. Larkin. After a word of welcome, Mrs. Gibb introduced Chester Watson, the well-known bass baritone, who, accompanied by Victor Vrasz at the piano, delighted all with his singing. Mrs. Karg introduced the chairmen and sponsors present from the various Sections who acted as hostesses. Mrs. Gibb then introduced the wives of the ASME Council members.

The meeting was then turned over to Mrs. Oberg who announced the Fashion Show entitled "The Bride in Fashion, Old and New," presented by the Traphagen School of Fashion, and introduced Mrs. Louise Stuart Beattie of the Traphagen faculty, who commented on the showing. Lovely bridal gowns from the School's museum collection were worn by especially selected small-sized students. Also shown were clothes for today, original designs by current Traphagen students, and a few creations loaned by former students now successful in the trade. Following the Fashion Show, Mrs. Oberg conducted the drawing for 44 door prizes, some contributed by the Metropolitan Section, the others by interested business firms. Favors of candy from Delta Airlines, cosmetics from Almay Schieffelin Company, letter openers from National Conveyors Company, calendar books from Rock-o-Marne, and bottles of pink champagne from San Benito Wine Company were on the tables for each lady.

Buffet Supper and Carnival Night

Tuesday's busy day culminated in a gala program which attracted 205 ASME men and women. It began at 6:00 p.m. in Penn-Top South with a "Wine-Tasting Hour," the Guild Wine Company having provided the California wines, which were served exclusively. Door favors were given to each guest; for the men—a gold pen provided by Shell Oil Company, or an automobile flare provided by Whitehead Metal Products Company, Inc., and for the ladies—perfume provided by the Metropolitan Section of the Auxiliary. Johnny Jarvis, the strolling accordionist, had voices raised in song all during the hour, while Dorothy Sara, handwriting analyst, startled and pleased people with her analyses of their handwriting. Carnival decorations—circus posters, balloons, masks, serpentines, carnival hats, an enormous floor clown loaned by Terry Drugs, Bloomfield, N. J., and programs with clown covers—contributed much to the gala mood.

A Buffet Supper was served at seven, while Johnny Jarvis played and sang at the piano. Beautiful colored movies of Mardi Gras in New Orleans, taken and edited by Mrs. George

W. Taylor of Rockford, Ill., with commentary by Mrs. Taylor, started off the evening's entertainment. Jerri Blanchard, well-known night club artist and song stylist, put on both her own show, a "Musical Frolic," and her Talent Show, in which she succeeded in getting several of the guests "into the act." Mr. Taylor then presented his "Mardi Gras in Port-au-Prince" movies, much to the pleasure of all. Co-chairmen for this outstandingly happy event were Mrs. R. W. Cockrell and Mrs. Donald V. Minard. For the evening's finale, Mrs. Gibb turned the door-prize drawing over to R. W. Cockrell, who presided at the winning of a basket of liquor, given by Byrne Associates; a General-Electric toaster and a General-Electric clock radio, given by Gries Reproducers Corporation; a Westinghouse electric fry pan, by Westinghouse Electric Corporation; Boker steak knives; and a LaCrosse manicure set.

Annual Business Meeting

The Annual Business Meeting of the Auxiliary was held Wednesday forenoon in the Dartmouth Room of the Statler Hotel, with Mrs. Karg presiding. Approximately 100 attended. Reports were given by the Auxiliary officers, the chairmen of the standing committees, and the section chairmen or their representatives. The Auxiliary has the following sections: Baltimore, Boston, Buffalo, Chicago, Cleveland, Columbus, Detroit, Fairfield County (Conn.), Honolulu-Hawaii, Inland Empire, Iowa-Illinois, Kansas City, Metropolitan (New York), Milwaukee, Minnesota, Omaha-Lincoln, Philadelphia, Pittsburgh, Southern California, Toledo, and Washington. The three chairmen of the Educational Funds also made reports. All reports were interesting and reflected encouraging progress and purposeful, constructive activity. Joseph W. Barker, retiring President of ASME, and William F. Ryan, incoming ASME President, visited the meeting. Dr. Barker stressed the need for keeping student members of ASME aware of the opportunity for full-fledged membership in ASME after graduation, and Mr. Ryan pointed out the value and advantages of the Society's meetings that accrue to members. Mrs. Robert Skinner of New York reported for the tellers of the election, who included Mrs. Higbie Young and Mrs. W. L. Iliff, both of New York.

The new officers were then introduced. They are: Mrs. U. Amel Rothermel, New York, President; Mrs. R. W. Worley, Philadelphia, First Vice-President; Mrs. R. L. Goetzenberger, Washington, Second Vice-President; Mrs. W. S. Major, Pittsburgh, Third Vice-President; Mrs. T. S. McEwan, Chicago, Fourth Vice-President; Mrs. H. C. Windmiller, Iowa-Illinois, Fifth Vice-President; Mrs. Arthur M. Gompf, Baltimore, Recording Secretary; Mrs. E. S. Bristol, Philadelphia, Corresponding Secretary; Mrs. Gordon R. Hahn, New York, Treasurer; and Mrs. G. S. Gethen, Philadelphia, Assistant Treasurer.

Mrs. Karg, who has had a very successful administration, gave a report, graciously thanking all who had served in office with her. She then gave the gavel to Mrs. Rothermel, who accepted it with brief inaugural remarks, emphasizing the importance of the Sponsor to each Section. The following were appointed to the Nominating Committee for next year: Mrs. C. Anderson, Boston; Mrs. John Somers, Metropolitan; Mrs. H. W. Cornelius, Philadelphia; Mrs. Louis Mantey, Cleveland; and Mrs. P. T. Lagrone, Pittsburgh.

Luncheon in Honor of Past-Presidents

Upon completion of the Annual Business Meeting, 100 women went to the Fifth Avenue Hotel for a luncheon in honor of the past-presidents of the Auxiliary.

Mrs. Richard Austin, Mrs. J. Noble Landis, Mrs. Edward Stahl, Mrs. Robert Purdy, Mrs. Frank W. Miller, Mrs. R. F. Gagg, Mrs. Earl Smith, Mrs. M. S. Cumner, and Mrs. Roy V. Wright, all past-presidents, attended the Luncheon, and were seated at the head table with Mrs. Karg, Mrs. Rothermel, Mrs. Oberg, Mrs. V. A. McKillop, whose husband is president of Engineering Institute of Canada, Mrs. Gibb, who presided, and Dr. Smiley Blanton, the guest speaker. Mrs. Randall Purdy and Mrs. Charles M. Hickox were Co-chairmen of the event. Due to illness, Mrs. Hickox, also a past-president, could not attend. Immediately after luncheon Mrs. Gibb introduced Mrs. Rothermel, who in turn introduced Dr. Blanton, author of the current best-seller, "Love or Perish." Dr. Blanton's interesting talk on "Love in a Changing World" was enthusiastically received. An attractive musical program followed, with Frances Corsi playing the harp, and Victor Vraz the flute. Mrs. Gibb then introduced the past-presidents, calling on Mrs. Wright, whose tenure of office, 1925–1927, has priority, to address the group, which she did most charmingly. Mrs. Karg extended a greeting, and Mrs. Rothermel, who was then introduced, spoke briefly in her new capacity as incoming President of the Auxiliary.

Door prizes, provided by the Metropolitan Section, were given out with the assistance of Mrs. Oberg. Decorations of pink carnations, both real and artificial, and white snapdragons, pink table linen, pink programs and candles and dramatic spot lighting made the Pink Salon very beautiful. Mrs. J. W. Wilkenfeldt had ingeniously contrived an attractive pink and white carnation corsage of Kleenex (!) for each person present. Table favors of hand lotion pillows were provided by Socony Mobil Company and MBT Broth packets by the Romanoff Caviar Company.

Audrey Jocelyn Flower Show and Open House

Monday forenoon approximately 75 ladies were taken by bus to East 58th Street where, at a gallery across the street from her shop, Audrey Jocelyn, noted flower-arrangement teacher, lecturer, and demonstrator, gave an illustrated talk on the principles of composition with flowers. At 11:30 a.m. all went to her shop to see beautiful arrangements by her students and teaching staff, and were served sherry, Japanese tea, and tea cakes in the garden. Many expressed their pleasure with all they had seen and learned of flower arrangement at this Open House. Co-chairmen for this affair were Mrs. Rudolph F. Gagg and Mrs. J. W. Wilkenfeldt.

Farewell Luncheon—Hampshire House

Directly following Miss Joselyn's Open House, a bus took the ladies to the Hampshire House for the final luncheon meeting in the Cottage. With others who had come directly from the Statler, the total attendance was 110, capacity for this charming room with its decor of large pink and red roses on walls and ceilings. Gladioli in the same hues, together with soft greens, carried out the color scheme. Seated at the handsome pink-lace-covered head table were Metropolitan Section Officers Mrs. Arthur M. Perrin, Mrs. R. W. Cockrell, Mrs. Anderson Peeler, together with Mrs. Oberg, Mrs. Karg, Mrs. Rothermel, Mrs. Gibb who presided, Fannie Hurst, guest speaker, Margaret Law, an honor guest, and the Co-chairmen of the luncheon, Mrs. Robert Skinner and Mrs. J. J. Moro-Lin.

Mrs. Gibb, after a word of welcome, introduced Mrs. Skinner, who presented the youthful and charming Peggy Frink, soprano, and Mildred Browne, her accompanist on the piano. The attractive musical program was followed by Mrs. Skinner's introduction of Miss Law, whose popular new book, "Aimee," is just off the press. Miss Law, a poetess, explained at Mrs. Skinner's request, that she had been inspired by her heroine to write a full-length book. Mrs. Skinner then introduced Fannie Hurst, who delighted all with her humorous and appreciative talk "Why I Like New York."

After the introduction of those at the head table, a few words of farewell were said by Mrs. Karg, Mrs. Rothermel, and Mrs. Oberg.

Mrs. Gibb thanked all Committee Chairmen and members for their wonderful support of the Annual Meeting activities. Mrs. Oberg conducted the drawing for door prizes, which had been contributed by the Metropolitan Section. Table prizes of lapel thermometers were contributed by J. Arthur Moore Company; Table favors of "Odalisque" Perfume were given by Nettie Rosenstein; blotters by Funk & Wagnalls Company; and bracelet charms by Gries Reproducer Corporation.

Tour of the New York Flower Market

The last event of the Annual Meeting was a tour of the wholesale flower market personally conducted by Miss Jocelyn, who took about 45 women to see orchids, unusual greens, exotics, and both dried and evergreen plants, providing an informative and memorable experience that only professional flower handlers would normally have. Co-chairmen of this much-appreciated event were Mrs. Gordon Hahn and Mrs. W. Wockenfuss.

This ended the events planned by the Metropolitan Section for the visitors at the 1956 Annual Meeting. The Metropolitan Section of the Woman's Auxiliary to the ASME enjoyed being the hostess section this year, and trusts that all returned to their homes carrying pleasant memories of the program.

Do the Oldsters Want Jobs? ESPS Wants to Know

By W. N. Carey, Secretary Emeritus, ASCE

ARE there many or few retired engineers, or others past 50, able and willing to take temporary jobs in engineering? Engineering Societies Personnel Service, the employment agency for the engineering societies, wants to know. The Board of Directors of ESPS has asked me to pose the question. Being on the retired list myself, both from the Army and from active professional work, and having served as a member and chairman of the Board of ESPS, the question seems to me well worth trying to answer.

Not Enough Young Men

The current shortage of engineers and scientists is a well-known fact. Continuous advertising in the newspapers of metropolitan areas and the quarterly combing of our campuses emphasize the need for young engineers and scientists. The supply does not begin to meet the demand for young men in these fields. Is the shortage confined to the young men, or does it include men in the older brackets in industry and government? Is it possible partially to meet today's need for engineers and scientists by temporary employment of men no longer young but willing and able to perform the required tasks? If such men are available and employers want them as temporary help, the task of trying to get employers and prospective employees together will be undertaken by ESPS.

It is realized, of course, that there are deterrents and complications in any attempt to employ older or retired engineers even temporarily on routine work. Some of the largest companies, whose engineer-recruitment efforts are the most impressive, simply will not hire engineers or scientists who are over 35.

Their reasons are sound where permanency in an organization is envisaged. But temporary, day-by-day, or week-by-week, employment of men to help level off peak loads need not affect the retirement system of a company nor interfere with lines of promotion, apprenticeship jobs, and other factors vital to employment planned on a permanent basis.

Can Older Men Help?

From the viewpoint of the older prospective employee, the 50-plus man or the Social Security beneficiary of over 65, there are deterrents too. These would tend to dampen the desire to take a "by-the-day" or week position as a temporary helper but not an integral part of a going organization. Granting the handicaps which exist from the viewpoint of both employer and prospective older employees, it still seems reasonable that some of the shortage of engineers could be met by greater use of the older members of our profession now unemployed or retired.

ESPS does not now know how many of such potential employees are available. If *you* are an engineer or scientist over 50, unemployed or retired, and if you are willing and able to take a temporary job, please tell ESPS. Send a brief letter to Engineering Societies Personnel Service, 8 West 40th Street, New York 18, N. Y. Just tell us your professional branch, your specialty, your age, and refer to this article.

ESPS Board Plans

If the response from the older men is adequate in numbers, the ESPS Board will attempt to work out a plan to bring these older engineers and scientists together with the industries needing them.

It should be borne in mind, of course, that ESPS, with offices in New York, Chicago, Detroit, and San Francisco, continues ready to help any engineer or scientist of any age better his position or to obtain one. ESPS also continues to try to locate the particular engineer or scientist any specific employer may want. These have been the routine tasks of ESPS for more than 25 years. The proposal discussed here contemplates a special kind of placement from a yet-unknown number of "prospects," 50-plus in years, who still desire to help themselves and their profession in the work of the nation.

Engineering Societies Personnel Service, Inc. (Agency)

THESE items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members or nonmembers, and is operated on a nonprofit basis.

In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office.

When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York	Chicago	Detroit	San Francisco
8 West 40th St.	84 East Randolph St.	100 Farnsworth Ave	57 Post St.

Men Available[1]

Assistant General Manager or Product Manager, AB and BSEE; 31; five years with major electrical manufacturer in electronics, ultrasonics, and mechanics; four and a half years with major hydraulic manufacturer in hydraulics, mechanics, and synthetic rubber; engineering, patents, sales, production, and administration. Desires New York or San Francisco. ME-348.

Development-Plant Engineer, MSME, BSEE; 47; 20 years' experience in design, construction, and operation of mining; metallurgical, and chemical plants and utilities in tropics and U. S. A. Desires East or Gulf Coast. ME-349-San Francisco.

Industrial-Management Engineering, BME, MIE; 34; electronics industries, twelve years. Project-Methods, editor, technical writer, engineer, teacher, radar technician, inspector. Seeks industrial-management post. Vicinity New York City. ME-350.

Supervisory Engineer, EE degree; 48; 18 years' supervisory experience in electromechanical development and design of medium-sized machines. Proved inventive ability. Thorough background of mathematics and physics. Desires: (1) East; (2) West Coast. ME-351.

Sales Manager or Assistant; BSME; 30; eight years' experience technical sales and administration in hydraulic and pneumatic power-equipment field; currently technical assistant to director of marketing. Location optional. ME-352.

General Manager, BSME; 38; eight years' management experience in engineering and marketing of aircraft power plants and equipment. Previous eight years in engineering and sales. Employees to 300. ME-353.

Director of Engineering; chief engineer, division manager, BSME; 51; experienced in design, renovations, expansion, and construction of plants in chemical, glass-container, and process industries. Supervision of machinery, materials-handling equipment design, and plant service and maintenance. Desires South, Midwest, or West Coast. ME-354.

[1] All men listed hold some form of ASME membership.

Positions Available

Instructors, mechanical graduates, to teach: (*a*) machine design; (*b*) power field. Opportunity for graduate work. $4200–$4500 for nine months. New York metropolitan area. W-3834.

Professor, master's degree in industrial or mechanical engineering, 35–45, to expand and teach industrial-engineering courses. Broad experience in industrial engineering highly desirable. Should be interested in academic work with a strong desire to teach. Salary open. New York metropolitan area. W-4232.

Executive Vice-President for a trade association, college training or equivalent such as provided by graduation from West Point, Annapolis or other accredited service academies; mature enough to have sound judgment. Will be responsible for the full-time administration and leadership of the affairs of the association, includ-

ing employment and direction of staff, publications, library, membership files and data; preparation for meetings, agenda, minutes and records, etc. Previous successful experience in association management is desirable, in lieu thereof, a record showing successful group management. Salary open; advise as to salary requirements. Midwest. W-4250.

Assistant Manufacturing Manager for manufacturer of medium and light-precision equipment in units and small quantities for paper and pulp industry as well as chemical and allied industries; 45–55; education in mechanical engineering, production management, or equivalent experience. Comprehensive knowledge is required of job-shop, precision-type manufacturing of medium and light-heavy industrial equipment. Knowledge should include machine work, welding practice, heat treatment, machine tools, machine practices, assembly practice, and the use and application of various materials. Must be competent in planning, scheduling, and materials control. To start, $10,000–$12,000, plus profit sharing and bonus arrangement. New England. W-4264.

Manager, Product-Research and Development Department, degree in chemical, metallurgical, or mechanical engineering, 35–45, to develop new products of high quality and wide application. Should have had experience in management of staff in development work. About $12,000–$15,000 to start. Mass. W-4265.

Industrial Engineer, 30–35, industrial or mechanical-engineering graduate, experience covering methods, cost, plant layout, warehousing, and inventory control, for consulting-management firm. $8000–$12,900. Reasonable amount of travel. Headquarters, New York, N. Y. W-4269.

Chief Engineer, mechanical graduate, at least ten years' project engineering and supervisory manufacturing experience covering conveyers, packaging, and materials-handling equipment. $12,000, plus bonus. Brooklyn, N. Y. W-4274-(*a*).

Engineers. (*a*) Central staff industrial engineer, BS or MS in industrial engineering, general engineering, or industrial management, ME, EE, and CE; experience not essential but will consider applicant up to five years out of college. Will develop new management-control techniques, help set policy on existing control systems, assist factory industrial engineering in administration of industrial-engineering policies and procedures. (*b*) Factory industrial engineer, BS or MS in industrial engineering, general engineering, or industrial management, ME, EE, and CE; no experience necessary but will consider applicant up to five years out of college. Will be member of the industrial-engineering staff at a factory location. Salaries open; company pays relocation expenses. (*a*) Ohio; (*b*) numerous throughout the U. S. W-4276.

Engineers. (*a*) Production foreman, BS or MS in ChE, ME, EE, CE, Chemistry, general engineering, industrial engineering, or industrial management; no experience essential but will consider an applicant out of college approximately five years. Responsibilities will include production of product, maintaining quality standards, and controlling cost of operations, etc. Salary open; company pays relocation expenses. Various locations throughout U. S. (*b*) Packaging Engineer, BS in chemical engineering or AB, or BS in some science or engineering course that provides work in chemistry; no experience essential but will consider an applicant to approximately ten years out of college. Work will consist of evaluating various packages and packaging materials for use on soap, food, and cosmetic products. Some traveling, about five per cent of time. Salary open; company pays relocation expenses. Headquarters, Ohio. W-4277D.

Engineers. (*a*) Manager of Power-Plant Development Division, 35–50, graduate mechanical or electrical, power option; ten to 15 years' experience in thermal power-plant design, development, economic studies, and sales; a good working knowledge of the U. S. power industry as well as an acquaintance with key personnel in this industry is essential. Will be responsible for bringing the service of the company in the design and construction of thermal power plants to attention of clients; keep abreast of potential new power-plant construction and expansion of existing facilities, etc. Salary open. (*b*) Manager of Power-Plant Project Division, 35–50, graduate mechanical or electrical, power option; ten to 15 years' experience primarily in thermal power-plant engineering including experience in design, layout, and project engineering covering essential elements of a modern thermal power plant. Will be responsible to manager of engineering for the furnishing of consulting services, engineering studies, development of basic scope and criteria, co-ordinating preparation of detailed plans and specifications, etc. Salary open. West Coast. W-4287.

Engineers. (*a*) Manager of engineering, 40–50, graduate civil or mechanical engineer, ten to 15 years' experience in engineering to include experience in design, project engineering, and at least several years as manager or assistant manager of a large engineering department, division, or chief engineer of an operating company. Some experience in steel-plant engineering is desired. Duties will include furnishing engineering services to clients, including consulting services, engineering studies, development of basic scope and criteria, estimates of costs, etc. Salary open. (*b*) Manager of Steel-Plant Project Division, 35–50, graduate mechanical or civil engineer, ten to 15 years' experience primarily in iron and steel-plant engineering including experience in design, layout, and project engineering relative to the essential elements of an integrated steel plant, including raw-materials handling and processing. Must have a proved record in responsible charge of engineering work in connection with iron and steel plants. Will be responsible to manager of engineering for furnishing consulting services, engineering studies, development of basic scope and criteria, etc. Salary open. West Coast. W-4288.

Engineers. (*a*) Senior industrial engineer, graduate mechanical, 35–45, five to ten years' experience in industrial engineering for a major appliance manufacturer or related firm such as auto-accessory manufacturer. Methods background; tooling experience helpful. Will be responsible for all phases of industrial engineering in appliance division; specifically, manufacturing methods, procedures, work flow, incentives, standards, and some special machine and equipment design. $10,000–$12,000, plus fringe benefits. (*b*) Chief quality-control engineer, degree in engineering or sciences; SQC course imperative; 30–45; five to ten years' experience as chief quality-control manager or assistant chief in a large corporation engaged in manufacture of major appliances. Must have had experience in establishing manufacturing standards and specifications, as well as supervising the inspection of fabricated materials and assemblies against specifications. Such product experience as washers, dryers, refrigerators, disposers, etc., would be desirable. $12,000, to start, plus fringe benefits. Calif. W-4296.

Sales Engineer. BSME or BSAE, 28–50, a minimum of four years' applicable experience with mechanical, electrical, and hydraulic accessories of which some part must have been in sales or customer liaison. Experience must be with aircraft industry or a competitor. Will contact customers and government agencies; must consider capabilities of meeting customer design and production requirements; act as liaison between engineering and procurement groups to provide technical assistance and co-ordinate services. $8000 to start. May live in Cleveland or New York. Territory, N. Y.–N. J. area. W-4302.

Plant Engineer for a paper mill, technical graduate or equivalent, who is capable of taking full responsibility for all construction maintenance and repair work, and take charge of steam and power plant. Permanent. Salary open. New England. W-4316.

Design Engineers. (*a*) Design engineer, mechanical graduate, at least five years' experience covering design, specifications, and performance evaluation of small rotating pumps, compressors, turbines, or similar machinery. $8000–$11,000. (*b*) Design engineer, mechanical graduate, at least three years' experience in product design, stress or vibration analysis, or functional performance of rotating equipment. $6000–$8000. Company will pay placement fee. Eastern Mass. W-4331.

Production Manager, graduate mechanical, 38–42, for manufacturer of precision equipment. Must have experience in light mechanical operations (presses, screw machines, gear cutters, lathes, etc.), complex lightweight assembly fine; toolmaking, etc., with necessary administrative skills in production planning, cost controls. $25,000–$30,000. Midwest. W-4334.

Plant Engineer, 30–40, engineering graduate, at least five years' experience in paper-mill and paper-converting industry. $10,000. Eastern Pa. W-4338.

Maintenance Superintendent, at least five years' plant engineering and supervisory maintenance experience, to take charge of mechanical and electrical equipment in diesel power plant, electrical distribution in open-pit mine, and repair machine shop for mining and milling facilities. $12,000–$15,000. Brazil. F-4340.

Mechanical Engineer, mechanization engineering, BS, MS, or PhD in mechanical engineering, with development background in special machinery; experience in machine design, and broad knowledge in such mechanical fields as high-temperature vacuum, servomechanisms, welding, and special materials. Will develop and design special machinery for manufacture of semiconductor devices; apply new physical and mechanical theories to development and production-type machinery; conduct whole projects of a variety of machinery and processing equipment for the complete manufacture of a product. $6540–$12,175. Company will pay placement fee and relocation expenses. Upstate N. Y. W-4351(*a*).

Product-Design Supervisors, young, graduate engineers, three to ten years' experience in the sheet-metal fields. Experience in architectural sheet metal, especially office partitions, hollow metal doors and frames, and library shelving and fittings highly desirable. Will supervise the preparation of design drawings including analysis of the function, appearance, and cost of the product. To start, $7000–$9000. East. W-4353.

Sales Engineer, graduate mechanical, air conditioning sales experience covering fan coil and self-contained units, to contact consulting engineers, contractors, hotels, builders, and architects. Will promote the sale, application selling, render engineering advice to customers on products, and guide territory salesmen. Only local travel in New York City. $7000–$8000. W-4357.

Plant Engineer, 40–45, experience in maintenance, steam and electric, to handle the maintenance, repairs, construction, steam and electrical power in a small two-machine paper mill. No pulp mill but a bleaching system. Paper mill experience not a prerequisite. Salary open. Midwest. W-4360-D.

General Engineering Manager, 35–50, to report to vice-president, for manufacturing company engaged in design, manufacture, and sales of radio and electronic instruments. Supervise all engineering departments, methods and process in manufacturing, new products, etc. Must be good administrator. $15,000–$20,000. Eastern Ohio. W-4362.

Project Engineer, mechanical graduate, to take one or more projects, mechanical or electromechanical instruments, through engineering and get into production. $8000–$11,000. Company will pay placement fee. Northern N. J. W-4364.

Supervisory Design Engineer, graduate mechanical, minimum of ten years in design engineering and specifications for power plants, distribution piping including stress analysis, knowledge of design and selection of prime movers for chemical and petrochemical processes. Will be responsible for technical and administrative supervision of personnel; for solution and completion of design problems in mechanical piping, equipment specifications, and selection of equipment, etc. Travel about 20 per cent of time. Salary open, plus fringe benefits. Headquarters, New York, N. Y. W-4368.

Assistant Quality-Control Manager, graduate mechanical or electrical, 29–45, minimum of five years' experience in the precision-instrument or bearing field with an intimate knowledge of precision gaging and quality control methods. Under direction of quality-control manager will plan and establish quality-control procedures, assist in maintaining quality control program. Will be responsible for supervision of major departments consisting of receiving inspection, inprocess inspection, etc. $6000–$7000, depending upon education and experience. New England. W-4369.

Industrial Engineer, 35–45, to install new time-study system in heavy machine-shop operation. Plant employs approximately 2000 people. Will also institute new wage incentive plan. To $10,000. Northern Mass. W-4370.

Plant Engineer, mechanical graduate, eight to ten years' experience for central engineering staff of large multiplant operation in the food process industry. Must know water, piping, air conditioning, ventilation, etc. Some design as well as field work. To $12,000. Minn. W-4372.

Project Engineer, graduate mechanical, to supervise the design of all facilities in rolling mills, including all extruded small parts such as shells and brass operations. To $12,000. New York, N. Y. W-4373.

Director of Engineering, under 50, to be entirely responsible for all engineering on small rotating electromechanical equipment, small commercial gears, and transmission devices. $18,000. Northern N. J. W-4374.

Field Engineers, civil or mechanical graduates, to erect precipitators on the job site—power plants, steel mills, chemical plants, paper mills, and other like installations. $6600–$7800, for experienced engineer. Some traveling involved about every six months. In addition to salary, $9 per day living expenses. Traveling expenses paid for applicant and family to the job site. Also 12½ per cent company paid pension plan and

other company benefits. East. Headquarters, N. J. W-4378.

Plant Manager for a manufacturer of specialty bronze bearings and castings; technical education desired. Must be qualified to take complete charge of a nonferrous foundry and machine shop. About $7800. N. J. W-4380.

Instructor in Mechanical Engineering, PhD or MS degree, to teach undergraduate mechanics and thermodynamics. Recent research experience desired. Salary and rank open, depending upon experience. Position starts Fall, 1957. Pa. W-4383.

Project Engineer, BS or better in chemical or mechanical engineering from a recognized college; with sufficient experience to have acquired mature judgment and broad knowledge of the plastics manufacturing field. Will act in advisory capacity to management of two affiliated companies in the plastics field. One company is in packaging field. The other company fabricates thermoplastic items including lamination and printing operations. Will co-ordinate activities with production, purchasing, estimating, and sales functions through operating management. Salary open. N. J. W-4387.

Engineers for foreign operations. (*a*) Production engineers, graduates, with some industrial-engineering knowledge. Approximately two years' training in stateside fabricating plants for placement as superintendents in overseas plants. (*b*) Installation engineer to supervise installation of fabricating equipment and to train crews in the proper use of equipment in new plants. (*c*) Electrical engineer to provide calculations and designs for electrical equipment and service for steel-mill production lines and for fabricating plants. (*d*) Mechanical engineer to handle design of steel-mill production equipment and fabricating plants. Salaries open. Headquarters, eastern United States. F-4393.

Application Engineer, EE or ME, 25–45, three or more years in electric-circuitry and control-panel layouts design; know electromagnetic and electric circuits. Duties will involve application of industrial-control devices to meet special customer requirement including solution of problems. Will include water-control systems for automatic machines for a manufacturer of electric controls. Employer will pay placement fee. $6500–$8500. Ill. C-5246.

Chief Engineer—Steel-Fabrication Shop; mechanical degree or equivalent; minimum of five years' experience in estimating, shop production, plans preparation, and general engineering for a small and expanding fabricating shop (steel-structural shapes, plate work, pipe, and forms) sold to cities, contractors, engineers, users, estate, and construction industry. Opportunity to develop management interest in the shop. $7000–$8000, plus sharing plan. Southern San Francisco. S-2387.

Candidates for Membership and Transfer in ASME

THE application of each of the candidates listed below is to be voted on after Jan. 25, 1957, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

New Applications and •Transfers

California

AKERS, JAMES L., San Jose
• BRISSER, STANLEY A., Whittier
BINCKLEY, BASIL C., Ontario
GODDARD, WILLIAM A., Los Angeles
HORST, PHARES S., Los Angeles
LOWRY, ROBERT K., North Hollywood
MACNAB, EDWARD B., San Marino
MARIS, JOHN G., Sepulveda
MAY, GORDON H., San Jose
PAPICH, RAYMOND, San Diego
• SHARPSTERN, JAMES T., Arcadia
SUMMERS, ROBERT C., Culver City
SWARTZ, ROBERT K., Burbank
WARE, WILLIAM H., JR., Los Angeles

Colorado

GRAHAM, ROSS R., Littleton
JONES, DAVID W., JR., Denver
• MILLER, NATHAN H., Golden
• THEODORIDES, STEVE K., Wheat Ridge

Connecticut

FINNE, WILLIAM E., Groton

Delaware

CHRISTIAN, GENE A., Wilmington
GAUL, MILTON U., JR., Wilmington
SUTERA, SALVATORE P., Newark

District of Columbia

MATTHEWS, WILMOTH H., Washington

Florida

DENKEN, DONALD C., Warrington
ROSSELLE, ROBERT W., Miami

Georgia

HANDLIN, HARRY C., Savannah
• MOORE, CLARENCE P., 3RD, Atlanta

Illinois

BOBCO, WILLIAM D., Chicago
GRALEWSKI, GEORGE S., Chicago
HELLWIG, GORDON C., Maywood
HUTCHINS, JOSEPH L., Elmhurst
MACKENZIE, ROBERT S., JR., Chicago
NANCARROW, RICHARD G., JR., Evanston
PETERSEN, LUDVIG, La Grange
RIVA, LOUIS J., Chicago
ROBINSON, THOMAS G., Chicago
SIMON, VICTOR H., Park Forest

Indiana

• CLARKE, RALPH H., Crown Point
FISHER, EUGENE F., JR., Hammond
KLINE, LEO V., Lafayette
MCCAHON, JOHN O., Crawfordsville

Kentucky

MCMAKIN, Dwight M., Louisville

Louisiana

RUSCA, RALPH A., New Orleans
SNOW, WILLIAM E., JR., Baton Rouge
WILLIAMS, GERALD C., Baton Rouge

Maryland

BELL, GREGORY M., JR., Silver Spring
COOK, NEAL A., Pasadena
CORNISH, CORNELL D., Baltimore
GOETZ, MICHAEL B., Frederick
• GRAVES, GILMAN L., JR., Rockville
KARASIK, NATHAN, Baltimore

Massachusetts

• BLOWNEY, JOHN S., Lynn
CEROW, JOSEPH A., JR., Indian Orchard
GOWDY, GEORGE H., Cambridge
MITCHELL, RICHARD B., Boston
SCHMIDT, JOHN W., Cambridge
SWANSON, JOHN T., West Springfield
WHELAN, THOMAS J., Boston

Michigan

BRUNNER, JAMES S., Essexville
DEWALD, CHARLES F., Detroit
DE WILDE, ANDRIES C., Pleasant Ridge
GRANT, LLOYD R., Ann Arbor
LANDE, THOR, Saginaw
LEAKSO, LEO H., Ypsilanti
MCNALLY, HOWARD L., Mt. Pleasant
ROYER, JAMES A., Detroit
• STEVENS, HOWARD C., JR., Muskegon

Minnesota

LATHAM, WILLIAM D., Minneapolis
WAGNER, LOUIS R., Minneapolis

New Jersey

ARCHER, DURWARD C., West Englewood
CONRAD, DAVID A., Murray Hill
MACALUSO, CHARLES A., Harrison
MIDURA, HENRY J., Trenton
WALLACE, GEORGE M., Ramsey
WHALEN, JAMES J., Finderne
WHITE, CHARLES E., Waldwick
WOOD, JOSEPH R., Princeton

New York

BAKER, RALPH D., New York
BARBEN, ARNOLD H., Seneca Falls
BERTSCHY, ROLAND G., Massapequa Park
BIELK, RICHARD J., New York
BLOCK, NORMAN, Fresh Meadows
• BROWN, DALE H., Schenectady
CHAMBERS, HAROLD L., Dolgeville
• CRUICKSHANKS, BENJAMIN C., JR., Schenectady
CURNOW, WILLIAM J., New York
DAILY, WILLIAM B., Wellsville
DELFINO, JOSEPH C., Thornwood
DI GIOVANNI, FELIX V., New York
DI MONTE, ANGELO M., Yonkers
EATON, EARL S., New Hyde Park
FEIT, RONALD, Neponsit, L. I.
FUCHS, HELMUT F., Brooklyn
HARRIS, JOHN P., Wappingers Falls
KINTZ, LOUIS A., Greenlawn
KITTREDGE, DONALD F., New York
• KRICKMIRE, JAMES B., Rochester
KRINICK, EUGENE, Commack
• LEHNER, JOHN B., Mineola
MARCHETTI, MARIO E., Brooklyn
MCINTYRE, ALAN D., Ithaca
MOORE, HARRY W., JR., New York
OLMSTEAD, PHILIP J., Seneca Falls
OXENBOL-SORENSEN, POUL, Mt. Vernon
• SALINE, LINDON E., Schenectady
SCHILLING, MAX T., Medina

North Carolina

MAYNARD, HOWARD A., Matthews

Ohio

ALBERS, CLETUS J., Minster
BARNETT, ROBERT C., Akron
BURROWS, WILLIAM F., Springfield
DE STEPHEN, ALBERT M., Alliance
• FRIEDMAN, STANFORD J., Cincinnati
GOELINER, ALLAN R., Cleveland
HELLER, EDWARD L., Gates Mills
• HICKS, LEWIS F., Athens
RICE, HAROLD O., Massillon
SPOHN, WILLIAM H., Columbus
TROY, ROBERT L., Columbus
WIER, FRANK C., Newcomerstown
• WILE, GEORGE J., Hamilton
• WILLIAMS, EARL E., North Canton
WRIGHT, DALLAS E., Toledo

Oklahoma

BENTLEY, ROBERT H., Tulsa

Pennsylvania

APTULSKY, JOHN W., Hazelton
BACHMAN, GEORGE F., Clarks Summit
BRUNSCHWIG, MARVIN, Yeadon
CURTIS, DONA A., Latrobe
• FAWCETT, WILLIAM E., Latrobe
GAJEWSKI, WALTER M., Pittsburgh
GRISELL, CHARLES P., Pittsburgh
HAYWOOD, JOSEPH, Ambler
• MASNOVI, RENO, Pittsburgh
MCINTIRE, GEORGE H., Jeannette
PLINE, RICHARD A., Bradford
ROGACKI, CASIMIR A., Jeannette
STERN, JOSEPH G., Downingtown
• WERNER, FREDERICK W., Media
• ZERBE, JOHN E., Pittsburgh

Rhode Island

BLEMENBAUM, LOUIS G., Warwick
FERREIRA, EDWARD, Valley Falls
• THIELSCH, HELMUT, Providence

South Carolina

KIERSPE, ROBERT W., North Augusta
MEYER, THEODORE J., Ware Shoals

Tennessee

CHOAT, ERNEST E., Oak Ridge
HUIL, STANFORD G., Clinton
ISENHOUR, NOEL L., Kingston
PRESTON, MAX K., JR., Oak Ridge

• Transfer to Member or Affiliate.

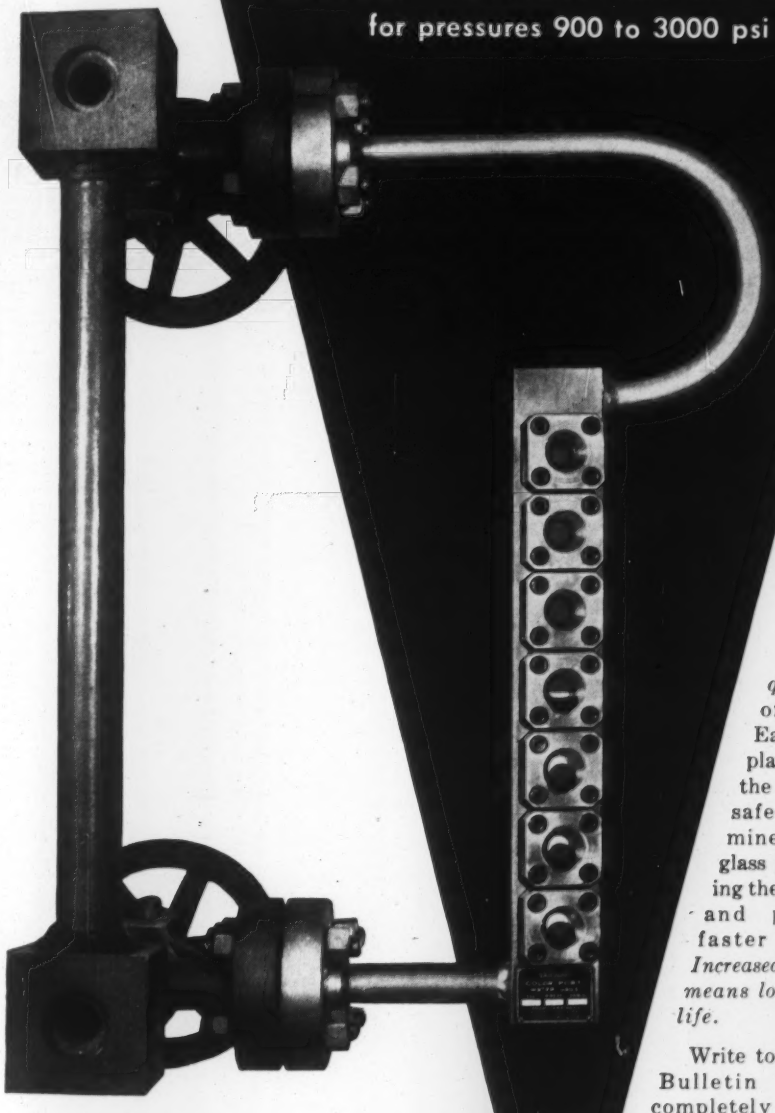
(*ASME News continued on page 126*)

NEW FROM YARWAY!

COLOR-PORT

BOILER WATER LEVEL GAGE

for pressures 900 to 3000 psi

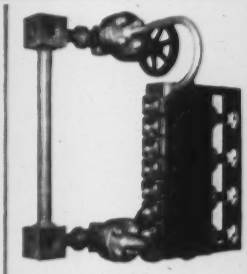


- *two-color readings!*
- *reduced maintenance!*
- *increased availability!*

Now Yarway offers brilliant two-color boiler water level readings, combined with simplicity of gage maintenance and increased availability.

With the new Yarway Color-Port Gage, water space shows green, steam space shows red. A full gage is all green and an empty gage all red.

The Color-Port Gage is *serviced quickly in place* by simple replacement of individual cover-glass assemblies. Each cover assembly is held solidly in place by four socket head capscrews and the "floating assembly" design applies safe predetermined loads on glass ports, reducing thermal shocks, and permitting faster warm-up. *Increased availability means longer service life.*



Side view of Yarway Color-Port Water Level Gage with illuminator, circulating tie-bar and Welbond gage valves.

Write today for new Bulletin WG-1814, completely describing Yarway Color-Port High Pressure Water Level Gages.

YARNALL-WARING COMPANY

108 Mermaid Avenue, Philadelphia 18, Penna.

BRANCH OFFICES IN PRINCIPAL CITIES.

YARWAY WATER LEVEL GAGES

Texas

CHESTNUTT, NELSON P., Dallas
OPPERSTENY, EDWARD J., Texas City
PRATHER, CHARLES L., Beaumont
● RIPPLE, CLIFFORD M., Houston
RUINEN, JOHAN, Houston
SCHRODER, WILLIAM E., Dallas
STONE, RICHARD J., Dallas

Vermont

MCLEOD, DARROW R., Rutland

Virginia

CYWIN, ALLEN, Alexandria
JONES, WARNER B., Richmond
KELLY, MICHAEL H., Culpeper

Washington

ELLIS, BURTON J., Seattle

West Virginia

MIDDELRAAD, HENK, South Charleston
WATSON, WILLIAM A., Charleston

Wisconsin

COLE, ALOYSIUS A., Waukesha
DOLINSKI, GEORGE, West Allis
JUSTUS, EDGAR J., Beloit
KOLF, RICHARD C., Milwaukee
O'CONNELL, MARK J., Racine

Foreign

ASPENBERG, ERIK V., Linkoping, Sweden
BAKER, THOMAS P., Windsor, Ont., Canada
FREEMAN, HENRY G., Sheffield, England
GUEUESSIER, ANDRE L., Ugine (Savoie), France
JAYARAO, GAINEDY, Bangalore, India
● QUAN, DAVID F., Toronto, Ont., Canada
● QUAN, DICK, Toronto, Ont., Canada
RAVAGLIA, ENNIO, Zurich, Switzerland

Transfers from Student Member to Associate Member 103

Obituaries

John Douglas Alden (1877–1956), who retired in 1944 after 16 years as gas engineer for the Jersey Central Power & Light Company, Asbury Park, N. J., died recently according to information received by The Society. Born, East Orange, N. J., May 13, 1877. Parents, John Berry and Ellen (Tracy) Alden. Education, special student, 1 year, Columbia University, 1895; ME, Stevens Institute of Technology, 1903. Married Rachel Weston, 1920. Mem. ASME, 1912. A director, N. J. Gas Association; he was also a member of the American Gas Association.

Wayne Stevenson Beattie (1893–1956), professor and head of the mechanical engineering department, University of Colorado, Boulder, Colo., died suddenly in Washington, D. C., on Sept. 8, 1956. Born, Roswell, N. Mex., April 25, 1893. Parents, John Francis and Helen Laura (Stevenson) Beattie. Education, University of Colorado, BS(ME), 1917, ME, 1921. Married Ethel Josephine Wilson, 1917, deceased 1934. Married 2nd, R. Louise Hubbard, 1940; sons, Lyle Wayne and Harold Francis. Except for a brief period after graduation in 1917, when he was employed as a tester of floor compressors for the Ingersoll-Rand Company, Easton, Pa., his entire career was as a member of the faculty of the University of Colorado, where he became an instructor in mechanical engineering in 1917, professor in 1941, and head of the department in 1947. Mem. ASME, 1937; he took an active part in Section activities and served for several years as honorary chairman of the Student Branch. He was also a member of ASEE, Tau Beta Pi, Sigma Tau, and Pi Tau Sigma.

W. Dean Burton (1882–1956?), specialist in machine design, particularly of gears, lived in retirement at Menlo Park, Calif. Born, Plattsmouth, Neb., May 15, 1882. Parents, George Frederick and Letitia Estelle Burton. Education, common school and private instruction. Married, Violet Mary Nurse, 1910; daughter, Elizabeth Amy. Assoc.Mem. ASME, 1914; Fellow ASME, 1949. A design engineer for the 200-in. Mt. Palomar telescope while on the staff of the California Institute of Technology's Astrophysics Laboratory, he also held about 25 patents in other fields. These included special mechanical equipment for maneuvering and handling lighter-than-air craft; a stoker-feed system and stoker improvements, equipment used on railroad cars and in the construction of dams.

Herman Wood Carnes (1904–1956), assistant division superintendent for the separation of isotopes, Union Carbide Nuclear Company, Oak Ridge, Tenn., died on Aug. 24, 1956. Born, Lima, Ohio, April 8, 1904. Parents, Calvin K. and Mabel M. Carnes. Education, BS(ME), University of Michigan, 1928. Married in 1924; sons, John H., William C., Calvin K.; daughter, Mable M. Jun. ASME, 1929; Mem. ASME, 1943. He was also a member of the Indiana Engineering Society and the American Gas Association, being an alternate member of the Hotel Equipment Committee of the latter. A specialist in the design of equipment for the utilization of liquid petroleum gases, he held more than half a dozen patents in that field. He had been associated with the Union Carbide Corporation since 1929.

Hugh Roderick Carr (1898–1956), treasurer and chief consulting engineer, Mech-Chem Engineering, Inc., Newark, N. J., died on Oct. 3, 1956. Born, Corry, Pa., May 6, 1898. Parents, Oma and Blanche (Kercheval) Carr. Education, ME, Cornell University, 1920. Married Bessie N. Nicol, 1928; daughter, Jean Kercheval. Mem. ASME, 1935. He was also a member of NAPE, and had served as educational director. A specialist in power-plant and boiler chemistry, he held patents on a pulverizer and air preheater, and had served as a consultant for more than 25 plants.

Frank Alfred Clary, Jr. (1906–1956), mechanical designer of San Jose, Calif., died Aug. 4, 1956. Born, Bayonne, N. J., Nov. 16, 1906. Parents, Frank Alfred and Josephine (Rathbun) Clary. Eduction, BS, Massachusetts Institute of Technology, 1933. Assoc-Mem. ASME, 1933. An instructor in mechanical engineering, Clarkson College, Potsdam, N. Y., 1938–1942, he was a mechanical-development engineer for the Naval Ordnance Laboratory, Washington, D. C., 1942–1945.

Allen Reginald Cullimore (1884–1956), president-emeritus of the Newark College of Engineering, died in South Orange, N. J., Sept. 20, 1956, after an illness of several months. Born, Jacksonville, Ill., March 2, 1884. Parents, Thomas McIntyre and Mary Pearce (Joy) Cullimore. Education, BS(CE), Massachusetts Institute of Technology, 1907; SD, University of Newark. He also received honorary DE's from Stevens Institute of Technology, Rutgers University, and Newark College of Engineering. Married Edith Van Alst, 1912. Recipient of the Lammé Gold Medal of the American Society for Engineering Education in 1951. Mem. ASME, 1933. He long emphasized the obligations of engineers as citizens and served on the ASME Committee on Engineers Civic Responsibility from its inception, and as a member of the Legislative Advisory Committee and as Adviser to the Metropolitan Section in National Defense. A member of the ASEE, he had been on the Executive Committee and Council of that organization. Active on the Engineers' Council for Professional Development, he had been chairman of the Committee on Student Selection and Guidance and a member of the Committee on Professional Training. His civic service included membership on the Citizens' Advisory Committee to the Central Planning Board and other service for the City of Newark; delegate from Essex County to the New Jersey State Constitutional Convention; and chairman, Essex County Council of the Division Against Discrimination, N. J. State Department of Education. He was particularly interested in the rehabilitation of veterans, having lost an arm in a boyhood accident, and served as a member of the Board of Trustees of the Kessler Institute for Rehabilitation and on the Rehabilitation Committee of the War Manpower Commission. Prior to being selected as president of the Newark College of Engineering in 1920, he had been dean of engineering at the University of Toledo, 1910–1916; and dean of engineering, Delaware College, 1916–1920.

Gordon M. Evans (1885–1956), retired vice-president in charge of manufacturing, Kelvinator Corporation, Detroit, Mich., died Sept. 12, 1956. Born, New York, N. Y., April 20, 1885. Parents, Isaac and Justine Sarah (DesLandes) Evans. Education, BS, City College of New York, 1904; ME and EE, Cornell University, 1906. Mem. ASME, 1920. He was the author of a technical paper on the relation of simplicity of design to quantity production. A specialist in industrial management, he had held management positions with several automobile concerns in Detroit, Mich., and as general manager of the Budd Wheel Company, Philadelphia, Pa., prior to becoming a vice-president of the Kelvinator Corporation in 1928.

Henry Elmer Geyer (1899–1956), construction and maintenance engineer, pipeline department, Standard Oil Company of California, San Francisco, Calif., died Sept. 4, 1956 at Delake, Ore. Born, Washington, Ind., Sept. 22, 1899. Education, BA, Stanford University, 1922. Jun. ASME, 1925; Assoc-Mem. ASME, 1932; Mem. ASME, 1935.

Charles Winfred Good (1893–1956), professor of mechanical engineering, University of Michigan, died suddenly on Sept. 7, 1956. Born, Saginaw, Mich., May 17, 1893. Parents, Charles Hanson and Mary Winifred (Farrar) Good. Education, BS(ME), University of Michigan, 1918. Married Vera Lucile Tibbits, 1923; son, Charles Hanson; daughters, Martha Ann and Phoebe Jane. Co-author of "Internal-Combustion Engines," with W. E. Lay, 1931, and also E. T. Vincent in the 1944 revision. Jun. ASME, 1920; Mem. ASME, 1925; Fellow ASME, 1955. Active on several ASME committees, he was chairman, Oil and Gas Power Division, 1940–1941; chairman, Professional Divisions Committee, 1953; member, Board on Technology, 1953. He joined the faculty of the University of Michigan in 1918 as an instructor in auto mechanics and became professor of mechanical engineering in 1943; also assistant director, department of engineering research and its successor, the Engineering Research Institute, 1936–1951. His studies of combustion in internal-combustion engines led him to predict the difference in burning conditions with detonating and nondetonating combustion in spark-ignition engines and to show that some of the power loss with detonation was due to kinetic-energy effects rather than heat conductance alone. As engineering consultant for American Car and Foundry Company, New York, N. Y., which contracted with the Atomic Energy Commission for the mechanical design of certain thermonuclear test devices, assisted in their design, production, erection, and testing, 1951–1953.

Parker Malcolm Green (1908–1956), head, industrial engineering and management, Engineering Division, North Dakota State College, died April 20, 1956. Born, West Newton, Mass., 1908. Education, BS, Northeastern University, 1936; MA, University of Alabama, 1943; PhD, Ohio State University, 1947. Mem. ASME, 1911. Also a member of the American Society for Engineering Education, Society for the Advancement of Management, and the Industrial Engineering Society of Peoria. He was the author of "Plant Layout."

Walter Atwood Hall (1874–1956), retired consulting engineer, died Sept. 19, 1956, after a long illness. Born, Wallingford, Conn., Jan. 7, 1874. Parents, John Milton and Amorette Frances (Morse) Hall. Education, BS, Massachusetts Institute of Technology, 1895; BA, Harvard University, 1896. Married Lucile Caroline Reynolds, 1903; daughter, Marjory Lucile. The originator of the "distributed core type" transformer, he held more than ten patents on transformers. Mem. ASME, 1911. He had served on the ASME Committee for Standards on Turbines and Turbine Compressors.

Myles Fred Kalwitz (1918–1956), construction supervisor, Commonwealth Edison Co., Chicago, Ill., died Sept. 16, 1956. Born, Chicago, Ill., March 26, 1918. Education, attended Clemson A&M College, Clemson, S.C., for three years. Mem. ASME, 1954.

Albert Chesebro Larkin (1874–1956), a specialist in automatically controlled forced-draft systems for domestic heating plants, died suddenly on Oct. 3, 1956, at Montreal, Que., Canada. Born, Stonington, Conn., May 30, 1874. Education, attended Rhode Island Technical Drawing School, Providence, R. I., 1892. Jun. ASME, 1895; Mem. ASME, 1905. He is survived by his wife, Sallie R. (Swan) Larkin.

Frank Wagner Lynch, Jr. (1916–1956), whose death in August, 1956, was recently reported to the Society, was an administrative assistant in the Engineering Division, Arma Corporation, Brooklyn, N. Y. Born New York, N. Y., Sept. 22, 1916. Education, BS(ME), New York University, 1941. Jun. ASME, 1941.

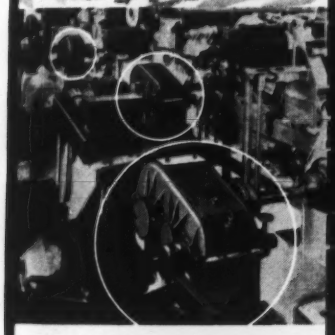
Michael Joseph Maloney (1881–1956), superintendent, The Rail Joint Company, Troy, N. Y., died June 8, 1956. Born, Troy, N. Y., Sept. 3, 1881. Parents, Michael and Margaret Maloney. Education, attended Rensselaer Polytechnic Institute. Married in 1915; sons Michael G. and John. Assoc.-Mem. ASME, 1921; Mem. ASME, 1935.

Harvey Blaine Mann (1883–1956), a consultant on heating and power-plant construction, whose

(*ASME News continued on page 128*)

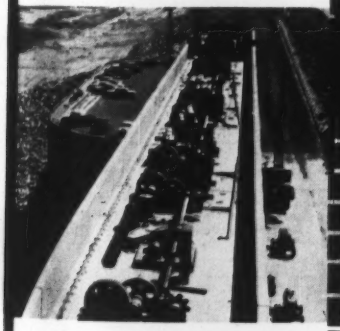
No. 1
in a series on
the application of
WESTERN GEAR
equipment

How WESTERN GEAR SPEED REDUCERS SOLVE "HORSEPOWER" TASKS OF INDUSTRY

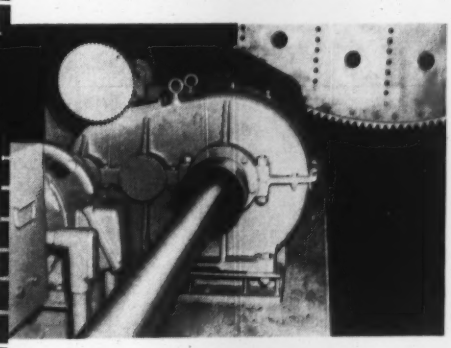


Paper machinery drives

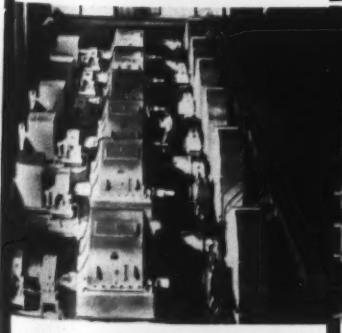
Cement kiln drives



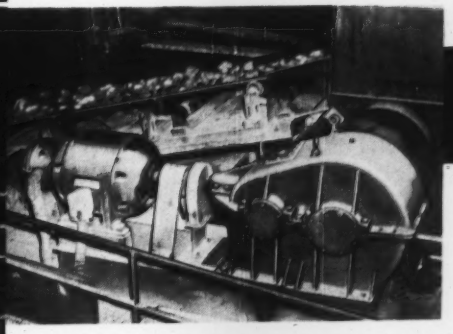
Dam gate drives



Bridge drives



Sugar mill drives



Mine conveyor drives

Basic industry today depends heavily upon speed reducers, the well-known gear drives that take high RPMs and convert them into slow-turning power. And since 1888 speed reducers have been a Western Gear specialty, unequalled for reliability and service. One of the primary reasons for this is Western Gear Hy-Q* gearing throughout the entire speed reducer line.

If your engineering problem involves speed reducers, one or hundreds, one to 10,000 HP, in any shaft arrangement, it will pay you to call in a Western Gear application engineer. With 68 years of experience at his finger tips, he'll take the problem and come up with a Western Gear speed reducer design that will give you trouble-free service and operation for years on end. Call on him now. There's no obligation. Address General Offices, Western Gear, P.O. Box 182, Lynwood, California. Phone NEvada 6-2161.

"The difference is reliability" • *Since 1888* 5637

WESTERN GEAR Corporation

PLANTS AT LYNWOOD, PASADENA, BELMONT, SAN FRANCISCO (CALIF.), SEATTLE AND HOUSTON—REPRESENTATIVES IN PRINCIPAL CITIES

*High Quality Gearing T.M. Pending

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information, you should be registered in the Division (no more than three) in which you are interested. Your membership card bears key letters, below the designation of your grade of membership and year of election, which indicate the Divisions in which you are registered.

Consult the form on this page for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions enrollment are correct. Please check whether you wish mail sent to home or office address.

Please complete the form below and mail it to: ASME, 29 West 39th Street, New York 18, N. Y.

Please Print

ASME Master-File Information

Date

LAST NAME | FIRST NAME | MIDDLE NAME

POSITION TITLE
e.g., Design Engineer, Supt. of Construction, Manager in Charge of Sales, etc.

NATURE OF WORK DONE

NAME OF EMPLOYER (Give complete name in full)

Division, if any

* ☐

EMPLOYER'S ADDRESS | City | Zone | State

ACTIVITY, PRODUCT, or SERVICE OF EMPLOYER; e.g., Turbine Mfrs., Management Consultants, Oil Refinery Contractors, Mfr's. Representative, etc.

* ☐

HOME ADDRESS | City | Zone | State

☐

PRIOR HOME ADDRESS | City | Zone | State

* CHECK "FOR MAIL" ADDRESS

I subscribe to

Address changes effective when received prior to:

☐ Mechanical Engineering	10th of preceding month
☐ Transactions of the ASME	20th of preceding month
☐ *Journal of Applied Mechanics*	20th of preceding month
☐ *Applied Mechanics Reviews*	1st of preceding month

Please register me in three Professional Divisions as checked:

☐ A—Aviation	☐ J—Metals Engineering	☐ R—Railroad
☐ B—Applied Mechanics	☐ K—Heat Transfer	☐ S—Power
☐ C—Management	☐ L—Process Industries	☐ T—Textile
☐ D—Materials Handling	☐ M—Production Engineering	☐ V—Gas Turbine Power
☐ E—Oil and Gas Power	☐ N—Machine Design	☐ W—Wood Industries
☐ F—Fuels	☐ O—Lubrication	☐ Y—Rubber and Plastics
☐ G—Safety	☐ P—Petroleum	☐ Z—Instruments and Regulators
☐ H—Hydraulics	☐ Q—Nuclear Engineering	

death on May 19, 1956, was recently reported to the Society. Born, Mill Hall, Pa., Nov. 17, 1883. Parents, Joseph R. and Anna P. (Taylor) Mann. Education, ME, Cornell, 1908. Married Elizabeth Burchfield, 1915; son, Robert; daughter, Jane B. Author of several technical papers on combustion, coal mining, and market analysis. Jun. ASME, 1911; Mem. ASME, 1918.

George M. Naylor (1872–1955), a specialist in the mechanical transmission of power, whose death in April, 1955, was recently reported to the Society, was president of The Fairbanks Company, New York, N. Y. Born, Cold Spring, N. Y., Jan. 11, 1872. Education, Walkill Academy and ICS. Mem. ASME, 1920.

George Kingdon Parsons (1880–1956), who had retired before World War II but returned to work in 1940 as a machine-tool adviser to the British Purchasing Commission, died Sept. 23, 1956, at Yonkers, N. Y. Born, Winnebago, Ill., March 27, 1880. Parents, Nahum Fisher and Nancy Adaline (Hendry) Parsons. Education, BA, Cornell University, 1902; ME(EE), 1904. Mem. ASME, 1911. Member AIEE and Sigma Xi. Author of technical papers on "Human Valuation," and "A Fair Basis of Profit Sharing." After his return from retirement in 1940, he remained active until 1951, including three years in China as senior engineer for the J. G. White Engineering Corporation, in connection with the work of the Marshall Plan. In 1918, he had organized the Merton Institute for Vocational Counseling in New York, N. Y. He also devised and published a library classification system for engineering literature used by the *Electric Journal*, Pittsburgh, Pa. He is survived by Mrs. Parsons, and a brother, Nahum, of Pasadena, Calif.

John Thomas Ramsden (1859–1951), who had retired at 89 as chief mechanical engineer for the Tabor Manufacturing Company, Philadelphia, Pa., died at age 97 on Aug. 17, 1951. Born, Easton, Pa., Nov. 24, 1859. Parents, Robert and Jane Ramsden. Education, day schools at Newton, N. J., and Nazareth, Pa., and grammar school at Philadelphia, Pa. Married Sarah J. Wilde, 1898. Awarded the Bronze Medal and Diploma of the Spring Garden Institute, Philadelphia, Pa. He held over 35 American and foreign patents, principally on molding-machine designs. Mem. ASME, 1906.

Harold A. Schreiber (1905–1956), mechanical engineer for the Easton Metal Products Corporation, Denver, Colo., died Sept. 18, 1956, after several months of illness. Born, New York, N. Y., 1905. Education, BS(ME), Denver University, 1949. Jun. ASME, 1950.

William George Seyfang (1885–1954), whose death approximately two years ago was recently reported to the Society. He had been managing engineer in charge of the design and construction of new buildings and maintenance of physical plant for the Board of Education, City of Buffalo, N. Y. Born, Buffalo, N. Y., Oct. 20, 1885. Education, ME, Cornell University, 1909. Mem. ASME, 1946. Also a member of ASCE; the American Society of Heating and Ventilating Engineers.

Sidney Charles Singer (1885–1956), Northern Division manager, Southern California Gas Company, died in March, 1956. Born, Cleveland, Ohio, 1885. Parents, Charles and Grace (Rosewater) Singer. Education, BS, Armour Institute of Technology, 1907, and ME, 1909. Married Corinne May, 1909; son, Sidney Charles, Jr. He was the author of various technical papers on gas-operating problems published in trade journals and the proceedings of the American Gas Association and Pacific Gas Association, and was a member of both organizations. Jun. ASME, 1909; Assoc.-Mem. ASME, 1916; Mem. ASME, 1921.

Thomas Lee Wilkinson (1867–1956), vice presidnt of ASME 1924–1926, a consulting engineer of Davenport, Iowa, died March 27, 1956. Born, Davenport, Iowa, March 20, 1867. Parents, Thomas C. and Sarah Ellen (McManus) Wilkinson. Education, BS(ME), University of Michigan, 1891. Married Burney Ragland, 1892; son, Thomas R.; daughter, Elizabeth. Married 2nd, Mary B. McKay Weldon, 1923. Honorary member, Tau Beta Pi. Member of the Board of Regents, University of Colorado. A specialist in power and the surface engineering of mining operations, he was the author of a number of technical papers. He had been a member of the Committee on Aims and Development of the American Society of Civil Engineers and was a Life Member of that organization. Jun. ASME, 1894; Mem. ASME, 1905; Fellow ASME, 1936. He had served as one of the organizers of the Colorado Section ASME, as a member of the Council, and as a member of a number of ASME committees.

Philadelphia's Convention Hall: Site of all events of the 1957 Nuclear Congress and International Atomic Exposition.

NUCLEAR 1957 CONGRESS

ATOMS FOR PROGRESS

for mankind's progress

Make your plans NOW to attend . . .

MARCH 11-15, 1957

•

PHILADELPHIA PENNSYLVANIA

2ND NUCLEAR ENGINEERING AND SCIENCE CONFERENCE
March 11-14, 1957

Sponsored and conducted by 20 leading engineering and scientific societies under the coordination of Engineers Joint Council.

More than 150 technical papers will be presented by the nation's leading engineers and scientists during 32 sessions covering such topics as:

- *Reactor Design, Metallurgy, Control, Instrumentation, Shielding and Construction*
- *Reactor Components, Operation, Maintenance; Standardization*
- *Waste Disposal; Water Supply Protection*
- *Natural Resources; Fuel Production and Processing*
- *Thermodynamics and Coolant Systems*
- *Safety; Radiation Protection*
- *Use of Educational Nuclear Reactors*
- *High Intensity Radiation Processing*
- *Fusion*

ADVANCE REGISTRATIONS HOTEL RESERVATIONS

For pre-registration forms and information on hotel reservations, write:

1. *Your own organization participating in the Congress, or*
2. *Engineers Joint Council*
   29 West 39th Street
   New York 18, New York

INTERNATIONAL ATOMIC EXPOSITION
March 11-15, 1957

Sponsored by the American Institute of Chemical Engineers with the cooperation of the American Society of Civil Engineers, the American Institute of Mining, Metallurgical and Petroleum Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

See the latest equipment, materials, and processes relating to the non-military uses of atomic energy in its various forms on display—many of them for the first time. Virtually all major suppliers or services to the nuclear energy field—from mining equipment and supplies to power distribution, electronics, chemical, metallurgical, mechanical, and many others—will display. Foreign industry and government will also be represented.

In addition to the thousands who registered for the technical sessions at the 1955 Nuclear Congress, over 15,000 registered to view the 165 exhibits—engineers, scientists, executives from industry, purchasing officials, press, educators, technical students, etc. Attendance at the 1957 Congress is expected to be even bigger.

Headquarters for exhibit information is:

International Atomic Exposition
117 South 17th Street
Philadelphia 3, Pennsylvania

5TH ATOMIC ENERGY IN INDUSTRY CONFERENCE
March 14-15, 1957

Sponsored and conducted by the National Industrial Conference Board (460 Park Ave., N.Y. 22)

Reports on current and future economic effects of atomic energy and the way experienced companies are dealing with managerial problems arising from the generation of nuclear power and use of atomic by-products in research and production. The 14 sessions cover such topics as:

- *New markets for new metals and how to realize them*
- *Better product development through radioisotopes, radiation chemistry*
- *Safety, health, insurance, legislation*
- *Status of foreign and domestic atomic energy developments*

5TH HOT LABORATORIES AND EQUIPMENT CONFERENCE
March 14-15, 1957

Sponsored and conducted by the Hot Laboratory Committee

More than 60 technical papers presented by designers and operators of laboratories handling radioactive materials. Six sessions cover new developments in hot laboratories and cells, remote handling equipment, and hot cell operation.

CONGRESS SPONSORS

AMERICAN CHEMICAL SOCIETY • AMERICAN GEOLOGICAL INSTITUTE • AMERICAN INSTITUTE OF CHEMICAL ENGINEERS • AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS • AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS • AMERICAN INSTITUTE OF MINING, METALLURGICAL & PETROLEUM ENGINEERS • AMERICAN INSTITUTE OF PHYSICS • AMERICAN SOCIETY OF CIVIL ENGINEERS • AMERICAN SOCIETY FOR ENGINEERING EDUCATION • AMERICAN SOCIETY FOR METALS • THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS • AMERICAN SOCIETY FOR TESTING MATERIALS • AMERICAN WATER WORKS ASSOCIATION • FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATION • HEALTH PHYSICS SOCIETY • INSTITUTE OF THE AERONAUTICAL SCIENCES • INSTITUTE OF RADIO ENGINEERS • NATIONAL INDUSTRIAL CONFERENCE BOARD • SOCIETY OF AUTOMOTIVE ENGINEERS • THE SOCIETY OF NAVAL ARCHITECTS & MARINE ENGINEERS

a new home for the WORLD'S "SMALLEST BUSINESS"

Miniature Precision's line of miniature and subminiature bearings includes more than 500 different types and sizes. The smallest of the bearings shown with the push pin has an outside diameter of 1/10th of an inch; is 3/100th of an inch thick, and has a 1/40th inch bore.

MINIATURE PRECISION BEARINGS, INC., KEENE, N. H.

Architect and Engineer:
ANDERSON-NICHOLS & CO., BOSTON, MASS.

General Contractor:
R. E. BEAN CONSTRUCTION CO., INC., KEENE, N. H.

Plumbing Contractor:
STICKNEY PLUMBING & HEATING CO., KEENE, N. H.

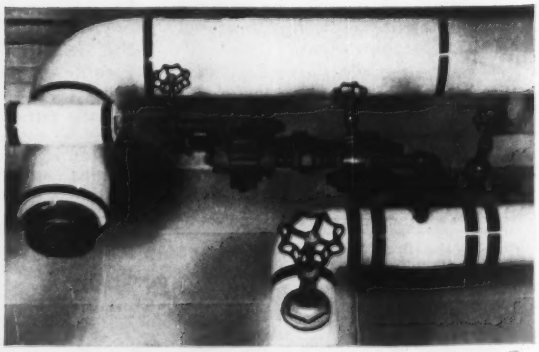
Heating & Air Conditioning Contractor:
ROYAL STEAM HEATER CO., GARDNER, MASS.

another modern plant equipped with JENKINS VALVES

Ball bearing assemblies so tiny that 500 can be carried in a thimble; held to tolerances so precise they meet the highest standards for radar mechanisms, gyroscopes, precision instruments — this is the "small business" in which Miniature Precision Bearings, Inc., is a specialist.

This company's fine new plant, located in the foothills of New Hampshire, was planned with the same critical appreciation of mechanical efficiency that typifies their product. Jenkins Valves were selected for dependable control of pipelines providing compressed air, steam, water, air conditioning and other services. Confidence in the extra measure of efficiency and economy of Jenkins Valves is shared by leading architects, engineers, and contractors, and by more and more managements concerned with future operating costs.

For new installations, for maintenance, in any plant — large or small — the Jenkins Diamond is your reliable guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17.



JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

SOLD THROUGH PLUMBING-HEATING AND INDUSTRIAL DISTRIBUTORS

KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

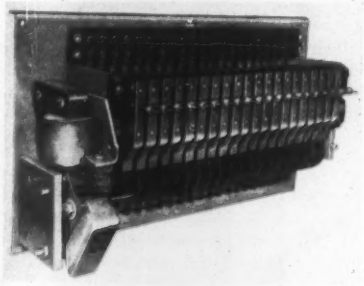
Available literature or information may be secured by writing direct to the manufacturer. Please mention MECHANICAL ENGINEERING.

NEW EQUIPMENT

Flow Regulator

Waterman Engineering Co., 725 Custer Ave., Evanston, Ill., announces a new adjustable flow regulator adapted for manifold mounting. Subplate kits are furnished with built in check valves for free reverse flow.

Minimum to maximum flow adjustments can be obtained by 180 deg movement of the control handle, the firm says. The unit weighs 5 lb. All exterior aluminum surfaces are anodized.



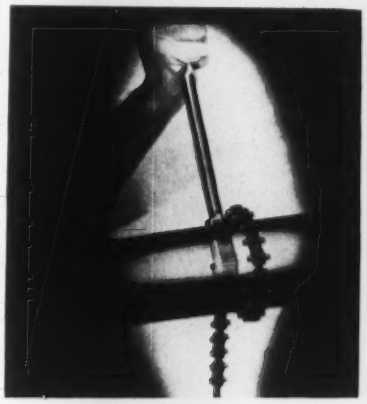
Heavy-Step Switch

A new heavy duty step switch for industrial application is now available from the Eagle Signal Corp., Moline, Ill.

The new "MT Series" Step Switch carries contact ratings of 10 amp. The rotary solenoid actuating coil operates directly on 115 v, 60 cycle current without the use of rectifiers.

The switch is available with one to twenty independent circuits. Independent cam-operated contacts make it possible to set up any given combination or group of combinations desired for a given application, the company states. Use of this device simplifies circuits and, in many cases, eliminates the use of auxiliary relays and other electrical components, it is said. It provides a positive interlock between sequence operations on one or more machines, on conveyor systems, batch mixing.

Although new in the industrial field, the step switch has been used, in variation, for switching mechanisms on the firm's traffic control devices.



Wrench, Vise Chain

Morse Chain Co., Ithaca, N. Y., has added WC-522 wrench chain to its line of standard industrial products.

The new chain is primarily for chain wrenches and vises but may also be used on any application where strength in tension, flexibility and quick, easy changes in chain wrap are necessary, the company states. Extended pins on both sides, each pitch provide quick, positive locking action. The firm says the natural flexibility of the chain permits it to hold any shaped material firmly without scratching or marring the surface.

The wrench chain is $\frac{5}{8}$ in. pitch; width over plates is .330 in.; and pin diameter is .200 in. Average ultimate strength is 7400 lb. Both pins and plates are hardened, alloy steel. Chains are supplied in the specific pitch length specified. A loose fit connecting pin is furnished with each chain for assembly.

Thrust Bearing

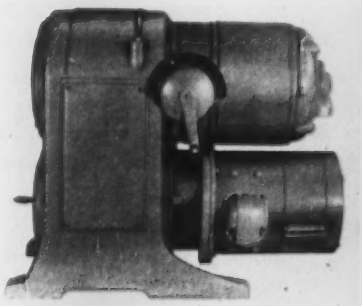
Rollway Bearing Co., 541 Seymour St., Syracuse, N.Y., announces a heavy-duty single-acting thrust bearing with a load capacity of 116,000 lb at 200 rpm, 76,500 lb to 700 rpm, and 67,800 lb at 1000 rpm. It is designed for steel applications such as pay off reel.

Thickness of the high-grade alloy steel thrust plates is $1\frac{1}{4}$ in.

According to the company, the plates are held to extremely close limits for parallelism for maximum linear contact. Special plates above are cantilevered to relieve inner race of radial bearing on left and outer race of radial bearing on right.

The thrust load is carried at right angles to the roll axis on 90 short, accurately dimensioned, cylindrical rollers. One roller, longer than other two in each slot, is staggered to equalize distribution of wear. The firm says the rollers are accurately spaced in machined bronze retainer, and compactly secured by a heavy steel band enclosing the retainer's outer edge. Retainer bore is widened to increase contact area and thus minimize retainer wear, the company states. Inner spacer sleeve on shaft and outer sleeve in housing provide operating float.

Completing the bearing assembly are two radial roller bearings. All radial rollers are crowned to relieve roller ends. The rolling surface is finished ground with a large radius for approximately one quarter of the length of the roller on each end. This is designed to eliminate high stress points otherwise developed when two cylindrical surfaces are in rolling contact under load.



Multiple Drive System

A more compact power unit for U. S. Electrical Motors' Varidyne system has been placed into production.

The power unit is now designed with the drive motor and alternator on the same side. This, the company says, provides variable frequency power to the motors in the system, thus electrically linking them together. This system has converted standard 60 cycle, 3-phase, a-c squirrel-cage motors into variable speed motors.

The alternator, driven at variable speeds, generates a frequency proportionate to its speed and transmits this variable frequency to each of the motors in the system. By changing speeds at the power unit by means of a handwheel, each motor in the system varies equally and simultaneously.

Enclosures available include drip-proof, totally-enclosed and explosion-proof de-

Standardaire Blower unloads 20 tons of flour in 50 minutes

In the next 50 minutes, this one operator will have unloaded twenty tons of flour from this huge International Milling Company trailer directly into a baker's storage bins.

The problem of rapidly unloading flour in such quantity, with no leakage, clogging or contamination, was solved by a *Standardaire* blower . . . the only blower found capable of meeting all the specific requirements involved.

This blower (shown in the front of the van) occupies a floor space of only 26″ x 21¾″. When driven by a 20 hp motor it provides an air flow sufficient to move flour as far as 125 feet in any direction . . . including straight up.

Today, due to its proved satisfactory performance, International Milling Company, Minneapolis, one of the largest millers of bakery flour in America, has equipped its entire fleet of bulk flour trucks with *Standardaire* blowers.

A *Standardaire* blower will deliver more air, with less power consumption, than any other unit of equal size or weight. Find out about its many advantages. Write for bulletin B-154 today.

READ STANDARD
CORPORATION

BLOWER-STOKER DIVISION
370 LEXINGTON AVENUE, NEW YORK 17, NEW YORK

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

signs. A variety of internally-geared motors such as single, double and triple reduction as well as right-angle worm gearing may be used.

The system is said to be ideal for coordinating machinery, conveyors and other multiple drive operations. A characteristic of the system is that when motors are operating in tandem, as on a conveyor, each motor will equally share the load. Another advantage of the system is that Varidyne motors may be operated on standard 60 cycle a-c current either for testing purposes or for emergency stand-by power, the company states.

The speed ranges for the motors are available from 1 to 10,000 rpm and in ratios of up to 5:1. Higher speed ratios can be supplied. Motors can be furnished from ½ to 30 hp at maximum rpm. Power units are available to carry from 1 to 60 hp connected load. Further information is available from U. S. Electrical Motors Inc., Box 2058 Terminal Annex, Los Angeles 54, Calif.

Hot Water Generators

A new line of compact package generators designed specifically for forced circulation, hot water systems, has been introduced by the Cyclotherm Div., National-U. S. Radiator Corp., Oswego, N. Y.

Outputs of the new units range from 670,000 to 6,700,000 Btu, and from 4467 to 44,667 gross edr. They are made to handle varying requirements of large or small hot water heating systems, singly or in a battery. The company says the units can take recirculated water from return lines with wide temperature differentials.

Cyclonic combustion guarantees a minimum fuel efficiency of 80 per cent, the firm states. This method uses the entire heating surface of the firetube by forming the flame in a cyclonic shape and motion along the complete length of the furnace. The first pass through the firetube delivers 65 to 70 per cent of the fuel value, while the single pass of return tubes uses the heat of the residual gases for an additional 15 to 20 per cent efficiency.

In this operation, the hottest water is delivered first, the company explains. With just the one set of return tubes, no distortion takes place in the natural convection current. The water nearest the firetube becomes heated and rises while the cooler water, recirculated from the heating system, is drawn to the firetube wall.

Each model is adaptable to burning oil, gas, or a combination of oil and/or gas.

According to the firm, any changeover desired can be accomplished in a few minutes. Modulation controls on most models automatically regulate the amount of fuel to maintain the desired constant temperature.

Connections are made for fuel, water, electricity, hot water outlet, and flue. No foundation, excavation or instrumentation is necessary.

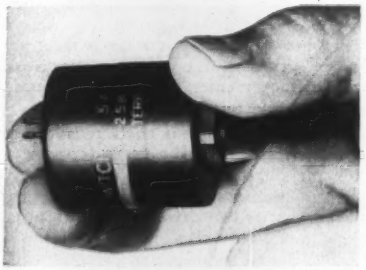
KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Miniature Synchros

Norden-Ketay Corp., Commerce Rd., Stamford, Conn., announces three minute size 23 synchros designed to meet all performance requirements and provide at least twice the accuracy specified in FXZ 1066, Rev.[4], Mil-S-16892 (BuOrd) and Mil-S-12472 (Ord).

The units are for use in airborne applications requiring accuracy with minimum bulk and weight. According to the firm, the new synchros eliminate in many instances the need for two-speed synchro systems, thereby reducing cost and effecting appreciable economies in weight, size, complexity, and gearing problems. Matched pairs of synchros are available.



Aircraft Pressure Switches

A new line of pressure switches specifically designed for aircraft use has just been added to the company's line of pneumatically actuated electrical devices, according to an announcement by Bristol Co. Waterbury, Conn.

The new switches are precision devices for switching electrical circuits in response to pressure changes in gases, liquids, and the atmosphere. According to the company, they will perform accurately and reliably in any position, and are designed for the environmental requirements of the appropriate MIL specifications.

The capsular elements which operate the snap-action switch have been specifically designed for this application, and assure maximum resistance to vibration, the firm states. Over-pressure protection is provided by the design of the assembly, in addition to the protection inherent in the capsular element itself. A variety of mounting arrangements are possible.

The new switches are available in two sizes; regular size for pressures between 5 psi and 150 psi, and miniature size for pressures of from 2 to 100 psi, each in absolute, gage, or differential as specified. Both types are regularly supplied in spdt snap-action type wired for NO or NC (two-terminal connector, or one terminal connector with ground) or wired for spdt with three-terminal connector. Contact ratings are 5 amp or 10 amp at 30 v d-c or 115 v a-c. Normal ambient operating temperature range is −65 to 250 F. They are hermetically sealed.

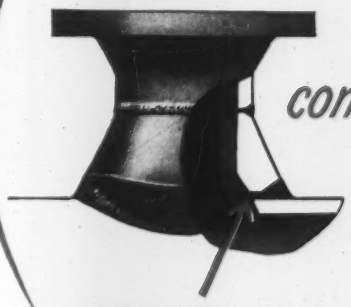
→ **years** to your piping

→ **gallons** to your flow

→ **strength** to an otherwise weak link

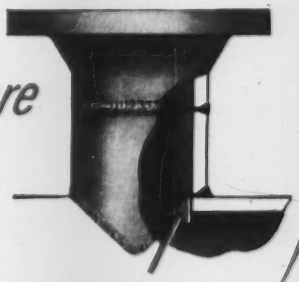
add → **BONNEY WELDOLETS**
to your piping drawings
for all branch connections

WELDOLET CONSTRUCTION



compare

NOZZLE WELD CONSTRUCTION



A STRONG LINK
adds years
gallons
strength
and assures a clean, properly fabricated
and properly designed branch connection

A WEAK LINK
for corrosion
external forces
internal pressure

Labor costs are now at an all time high. Reevaluation of your piping costs will now reveal Weldolets 4" and smaller to be less costly to fabricate than unreinforced nozzle connections. In the field this is also true of larger sizes and Weldolets are always more economical than branch connections made by welding tees or reinforced nozzles. Weldolets are manufactured in all sizes from 36" and all weights from xxs, in carbon steel, stainless, alloy, wrought iron and non-ferrous metals.

BONNEY

WELDOLETS ®
THREDOLETS ®
SOCKOLETS ®

PENNSYLVANIA DIVISION
BONNEY FORGE & TOOL WORKS
ALLENTOWN, PENNSYLVANIA DEPT. E

UNEQUALLED OPPORTUNITIES IN ENGINEERING

Now is the time . . . Convair is the place! Yes! If you are planning for a career in engineering look to Convair Pomona, the leader in Electronics. America's fastest growing young industry. Now engaged in Design, Development, Engineering and production of Electronic equipment and complex weapons systems. Convair-Pomona is the country's only exclusive guided missile plant, with the most modern, best equipped engineering facilities. Be first with Convair, live in the beautiful Pomona Valley only minutes from Los Angeles, the mountain, seashore and desert playgrounds. Country living near the city at its best!

Generous travel allowance to Engineers who are accepted. Write now enclosing a complete resume to: Employment Dept. 3-Y

CONVAIR
A DIVISION OF
GENERAL DYNAMICS
CORPORATION
POMONA
CALIFORNIA

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Iron Powder Electrode

Lincoln Electric Co., of Cleveland 17, Ohio, announces a new all-position, low hydrogen, iron powder type electrode called Jetweld LH-70.

The firm describes it as an electrode for general purpose welding of all steels with high currents and for welding crack-sensitive steels and steels tending to produce porosity in weld metal. It is said to have high deposition rate, easy slag removal, and excellent operating characteristics. According to the company, typical uses are for welding low alloy steels which must be welded without preheat, high sulphur-free machining steels, steels to be enameled, medium to high carbon steels and thick sections.

Iron powder in the coating produces deposition rates which result in welding speed 10 to 30 per cent higher than those obtained with low hydrogen electrodes without iron powder, the firm states. The coating is said to produce greater footage per electrode, necessitating fewer electrode changes.

Ease of operation is characteristic in all positions with either d-c electrode positive or a-c welding current, the company says. Bead appearance is claimed to be smooth and clean, spatter being reduced to an unimportant minimum. Slag is easily removed. Either a drag technique or a short arc technique can be used.

The electrode is classified as an ASW E-6016, but it also meets the requirements of classes E-6015, E-7015 and E-7016. It is available in $^1/_8$, $^5/_{32}$, $^3/_{16}$, $^7/_{32}$ and $^1/_4$ in. sizes.

High Vacuum Pumps

A new line of fast, Roots-type vacuum pumps is available from Rochester Div., Consolidated Electrodynamics Corp., 1775 Mt. Read Blvd., Rochester 3, N. Y.

Available in six standard sizes, they cover maximum speed ranges from 92 to 4900 cfm. Basic mechanism of the pumps is a pair of figure-eight-shaped rotors which counter-rotate in the pump chamber. These finely machined rotary pistons never touch one another or the pump casing, the company says. Consequently, no oil sealing in the pump chamber is required which would contaminate the vacuum system with back-streaming vapors.

The pumps have motors which operate within the vacuum, eliminating need for shaft seals, which are frequently sources of leakage. Roughing is done directly through the pump without the need of by-pass or valving.

The pumps are reported, by the company, to be the world's fastest mechanical pumps in the 10^{-1} to 10^{-5} mm Hg range. For example, the 39 × 20 × 22-in. size has a throughput of 10,400 micron-cubic fpm at 10 μ. This permits the pump to handle easily sudden gas bursts encountered with certain metals when the pump is used with a vacuum furnace, the firm states.

KEEP INFORMED | NEW EQUIPMENT BUSINESS NOTES LATEST CATALOGS

Roller Chain Sprockets

Double strand roller chain sprockets said to require no reboring or other machining for installation on shafts are being added to the Taper-Lock sprocket line now offered by Dodge Mfg. Corp., of Mishawaka, Ind.

The new double strand sprockets incorporate a modern method which enables users to take sprockets, together with bushings of the desired shaft size, directly off the shelves of distributors and mount them quickly and securely without reboring, keyseating or set-screw machining, the firm reports. This provides the equivalent of a shrunk-on fit, regardless, the company says, of whether the shaft is turned and ground or cold rolled, standard or normally undersized.

They are available in pitch sizes ranging from $^1/_2$ to 1 in. They are designed to be used with the firm's double strand chain or any other standard precision chain conforming to ASA specifications.

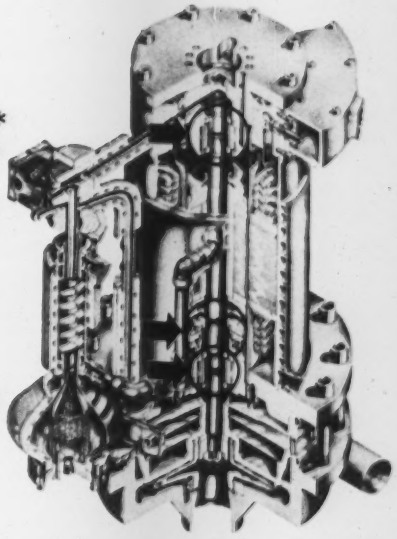
Plug Type Valve

A new plug type valve able to withstand the valve-killing punishment of sewage influent has been designed and manufactured by DeZurik Shower Co., Sartell, Minn.

The exclusive eccentric action of the valve swings the plug back and away from the seat to open wide with minimum effort and with no friction from the plug itself, the firm says. Closing the valve wedges the eccentrically-shaped plug against the eccentrically-raised seat, sealing tightly despite intervening solids.

Bonded to the metal plug-core, the Hycar rubber plug facing has the rigidity to close tightly, yet retains the surface resiliency to seal around solids which may lodge on the valve seat, the firm states. This resiliency also resists abrasion from solids in the flow, eliminating scoring on the plug face, an eventual source of leakage. The rubber is also said to have high resistance to chemical attack.

Both KENNAMETAL* and KENTANIUM* in Westinghouse liquid metal pump



Cut-away view of Westinghouse pump to handle liquid sodium, NaK or other metals at temperatures up to 1500°F. Circles show bearings and thrust runners of Kennametal and Kentanium, which meet the most rigid specifications of tolerances and quality of material to provide continuous, 100% leak-proof pumping operation for extended periods.

Bearings and thrust runners operate perfectly after 2000 hours handling sodium, NaK and other metals at 1050°F and above

Kennametal and Kentanium are sharing in one of the engineering advancements of the year . . . the Westinghouse centrifugal liquid metal pump designed for the atomic power industry. Kennametal grade K9** and Kentanium K138A** were selected for the vital bearing and thrust runner parts which are lubricated by liquid metal with a film much thinner than oil lubricants. Surfaces must not corrode and must be highly wear resistant to maintain leak-proof seals . . . rugged requirements which Kennametal and Kentanium have met under gruelling tests.

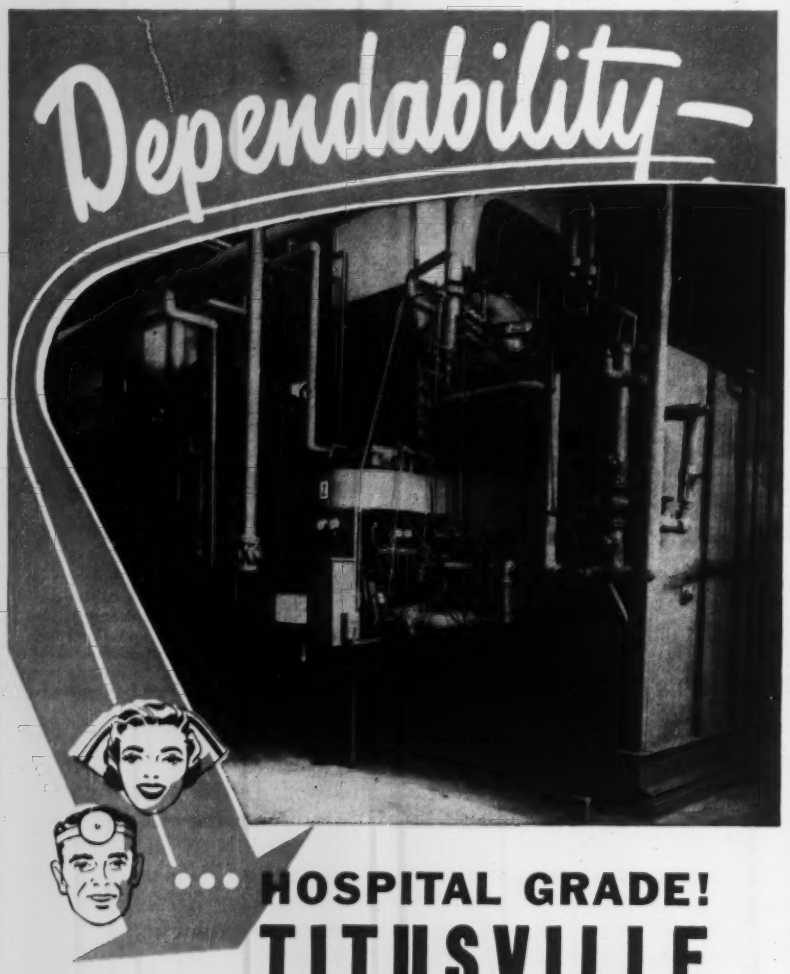
RUGGED ENDURANCE TEST: After 500 hours of operation with the pump stream at 1050°F (and 120 psi head), the pump was taken down and the Kennametal and Kentanium parts examined. They showed no change. Now, after 2000 hours of around-the-clock operation, these parts continue operation in apparent perfect condition. Larger Westinghouse pumps now being built to handle sodium and NaK at 4000 gpm and 1500°F at 250 psi pump head include similar parts of Kennametal and Kentanium.

These applications suggest the use of Kennametal or Kentanium wherever two surfaces rub together or are forced together . . . especially under severe conditions as encountered in handling liquid metals or other difficult-to-handle materials. Such applications might include valve seats, rings, bushings, sleeves on shafts, etc. Kennametal engineers are prepared to assist you. They have years of accumulated experience in the development of hard carbide metals to meet special requirements. Call or write KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademarks of a series of sintered tungsten and titanium carbides.

**Approved, Bureau of Ships Specification, Carbide Stocks for Bearings, MIL-C-18482, 20/4/55.

INDUSTRY AND KENNAMETAL ...Partners in Progress


Dependability—
... HOSPITAL GRADE!
TITUSVILLE
type WTP Steam Generators
Write for your copy of the latest Titusville WTP Catalog
The wide load variations encountered in hospital service are handled smoothly and dependably by the fully automatic, fully modulating features of Titusville's WTP Steam Generator. Shown are two Type WTP #12.5 units, serving a large eastern hospital with high efficiency over the entire operating range.
STRUTHERS WELLS PRODUCTS
BOILER DIVISION
BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units
PROCESSING EQUIPMENT DIVISION
Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters
FORGE DIVISION
Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening and Back-up Rolls
MACHINERY DIVISION
MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies
THE Titusville IRON WORKS CO.
A Division of Struthers Wells Corporation
Titusville, Pennsylvania
Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement
Plants at Titusville, Pa. and Warren, Pa.
Offices in Principal Cities

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Vertical Drafting Board

L. A. B. Corp., 10019 Onondaga St., Skaneateles, N. Y., has introduced a new "Easy Shift" vertical drafting board, designed to reduce draftsman fatigue.

The vertical feature of the board is said to prevent dirt and dust collecting on drawings and eliminate smudging. A drafting machine rests on the drawing with feather touch, the firm states.

The board is available in two models, one with fixed board angle of 15 deg from vertical and the other adjustable through an arc of 85 deg from vertical. Both models have an up and down adjustment of 20 in., permitting draftsman to work, seated or standing, at optimum visual angle in a comfortable position on any area of the board without bending or stretching.

Moving members are fully counterbalanced without using bulky counterweights. Vertical adjustment is held by a foot-operated lock mechanism. According to the company, a self-healing, no-glare plastic drawing surface recovers from pencil indentations and compass pointers, maintaining a uniformly smooth working area.

The frame of the vertical drafting board is of tubular steel construction with gray iron castings inter-connecting members. The board itself is of light-weight, aluminum-lined, honeycomb sandwich construction which is warp-proof and sufficiently rigid to withstand heavy loads without deflection. Accessory reference tables may be hinged to the back of the vertical drafting boards, making them ideal for series installation. Space savings of 30 per cent are said to be possible through the use of these boards.

Clinch Nuts

The range of clinch nuts employing the firm's self-locking principle has been enlarged by The Nylok Corp., 611 Industrial Ave., Paramus, N. J., to include sizes down to Number O. They are available in a range of ferrous and nonferrous materials.

The self-locking principle of the fasteners eliminates the need for lock washers, lock wires and other forms of safety fastening, the firm explains. The nuts cannot shake loose under severe vibrations and are effective in temperatures ranging from —70 to above 250 F. According to the firm, the nuts, used in the radio and electronics industries, provide excellent reusability. They meet the torque requirements of AN-N-5 and Signal Corps clinch nut requirements.

A rough resilient pellet of nylon is permanently imbedded in the body of each nut. The pellet projects beyond the threads, and, when engaged, is compressed into the threads. Its spring-like wedging action grips threads tightly, setting up a counter-thrust and creating a strong metal-to-metal contact of mating threads. The locking action is positive, whether the mating screw is seated or not. The screw can be inserted from either side.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

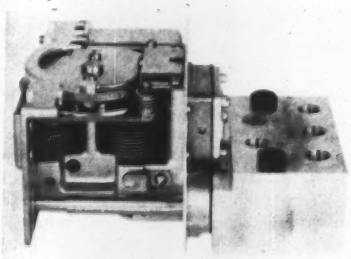
Automatic Work Positioner

A standard automatic work positioner is announced by Wilton Tool Mfg. Co., Schiller Park, Ill.

Described as Model 393 air powered hydraulic PowRarm, the new automated device is said to provide instant positioning of work pieces to any desired angle, leaving both of the operator's hands free. The cost is said to be less than most stationary fixtures that are custom made for specific jobs.

The complete assembly can be installed quickly on any bench or work station, and consists of a work positioner, air-hydraulic booster cylinder, foot pedal control, and all necessary hoses and fittings, the firm says. The hydraulic booster supplies the locking force, and is activated by 60 to 100 psi factory air line pressure.

The work weight capacity is 105 lb with 100 psi air input, permitting application of the tool to a wide range of electrical and mechanical assembly operations. A line of five manually actuated positioners is also available with capacities from 15 to 150 lb work weight.



Computing Relay

A universal pneumatic computing relay, Model 56-1, which can be adjusted to perform any one of six different arithmetic functions is being offered by Foxboro Co., Foxboro, Mass.

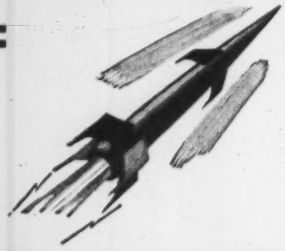
Six other relays are also available, each designed for a specific computing operation. Measurements are received by the relay as pneumatic signals, 3–15 psi; computer output to a recorder or controller is also in terms of 3–15 psi.

Consisting of a modified Model 58 Consotrol controller with new type manifold, the new series of relays operates on the force balance principle, with four bellows positioning a floating disk about a fulcrum. The disk acts as the flapper of a conventional flapper-nozzle detector. Forces exerted by pressures in the bellows establish the position of the disk in relation to the nozzle. The resulting pressure change in the feedback bellows maintains the balance position of the disk.

The manifold provides external connections to all four bellows so that measurement signals can be received and computed accord-

ACCURATE
CONTROLLED
Timed
LUBRICATION
The New 82-V vacuum pumping unit "with dry sight feed," an exclusive Manzel development will end your liquid sight feed problems. Install them on any existing Manzel lubricator. Now — more accurate than ever . . . it will pay you to get complete detailed information on this dependable, field-proven Manzel unit.
WRITE FOR COMPLETE CATALOG
Manzel
LUBRICATORS • CHEMICAL FEEDERS • SLURRY PUMPS
353 BABCOCK STREET • BUFFALO 10, NEW YORK
A Division of Houdaille Industries, Inc.

ENGINEERS: *Electronic & Mechanical*
Physicists:



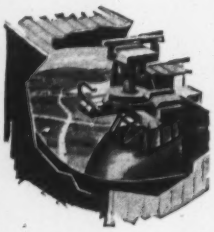
Work where PERFORMANCE pays off

Men of talent and drive can move ahead without delay or red tape at Melpar because skill, ability and performance are the *primary* factors governing advancement. Due to the fact that we've doubled in size every 18 months since our beginnings in 1945, middle and top level positions open up constantly.

Melpar believes that the engineer deserves an organization and facilities that can enhance his creative abilities. For this reason our laboratories were designed and built to specifications prepared by Melpar engineers. A wealth of equipment is available. Our project group system enables the engineer to participate in all phases of development problems and thus quickly acquire greater technical and administrative know-how, essential to eventual managerial responsibility. The system also enables us to more accurately evaluate the individual's contribution and more rapidly justify promotions.

Live Where You LIKE It

Living—for the whole family—is immensely rich in the two locales where Melpar's R & D activities are centered. Our 265,000 sq. ft. main laboratory near Washington, D. C., enables you to live in an area enjoying incomparable cultural and recreational advantages. The climate allows outdoor recreation 215 days of the year. Fine homes and apartments are available in all price ranges. Our Watertown and Boston, Mass. laboratories offer the unique advantages of cosmopolitan Boston with its theatres, concerts, art galleries, museums, universities and schools which are second to none. Nearby are seaside and mountain resorts offering a variety of winter and summer sports.



Openings Exist in These Fields:

Flight Simulators • Radar and Countermeasures • Network Theory • Systems Evaluation • Microwave Techniques • Analog & Digital Computers • Magnetic Tape Handling • UHF, VHF, or SHF Receivers • Packaging Electronic Equipment • Pulse Circuitry • Microwave Filters • Servomechanisms • Subminiaturization • Electro-Mechanical Design • Small Mechanisms • Quality Control & Test Engineering

Write for complete information. Qualified candidates will be invited to visit Melpar at Company expense.

Write: Technical Personnel Representative

MELPAR, *Inc.*

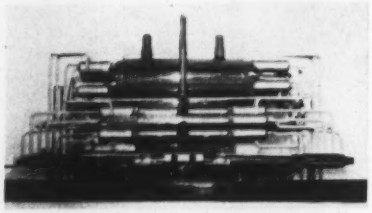
A Subsidiary of Westinghouse Air Brake Company

3612 Arlington Blvd., Falls Church, Va.

10 miles from Washington D. C.

ing to the equation desired. The adjustable fulcrum, the controller proportional band, is used to weight the various measurements according to their values in the equation. Substitution of springs for certain bellows will change the relay from one computing function to another.

According to the company, process applications include fuel-air flow ratioing, boiler swell compensation, and, flow totalizing on multiple lines. Virtually any arithmetical operation, such as addition, subtraction, multiplication and division, can be accomplished, the firm states.



Steam Generator Model

A scale model of a liquid metal heated steam generator is currently being shown nationwide by its developer, Griscom-Russell Co., Massillon, Ohio.

The device, developed for use in nuclear power generation systems, incorporates a number of operational and safety features particularly applicable to using hot liquid metals to generate steam from sodium or sodium-potassium cooled reactors, the company states.

One feature of the model's design is double tube construction which, combined with double tube sheets, forms two barriers to separate the liquid metal from the water and steam generated. This is said to be particularly important with alkaline metals, such as molten sodium, or sodium-potassium metals, since these metals react vigorously with water, forming the explosive gas hydrogen.

The heat is transferred from the hot liquid metal inside the chrome-moly steel inner tubes welded into tube sheets which form a part of the head, of each unit. These inner tubes are expanded tightly into the outer tubes throughout the entire length of the outer tube and heat is transferred from the inner tube to outer tube by conduction. The outer tubes are welded into tube sheets which form a part of the steam chamber or shell. Therefore, the company says, if either tube should break in service, or any tube joint should fail, the fluids would flow into an intermediate chamber formed between the two tube sheets. Fine grooves are formed on the outside of the inner, or liquid metal tube, or on the inner surface of the outer, or steam tube, forming passages to permit the flow of a monitoring gas into the intermediate space between tube sheets. Tubes are welded to the tube sheets by a new

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

automatic welding process that permits complete radiographic inspection of the completed joint.

Another feature of the design is the practicability of monitoring the intermediate space between tubes and tube sheets with a gas so that very small amounts of leakage can be rapidly detected. The large steam evaporator, with the two nozzles leading to the steam drum, uses a patented insulated core tube and a bayonet design to reduce the thermal stresses caused by the difference in tube wall to shell plate temperatures.

The small superheater located below the steam evaporator also has a bayonet construction with an inner core tube to guide the molten metal to the sealed end of the tube. In both units the hot metal returns in the annulus between the core tube and the inside wall of the inner or molten metal tube.

Panel Meter

A new lost cost panel meter said to combine extreme sensitivity with unusual shock resistance is announced by Assembly Products, Inc., Chesterland, Ohio.

Sensitivities of the new meter, designated Model 253-E, begin with a full scale range of from 0 to 20 μa, yet the meter will withstand punishment more rigorous than the standard military 1200 ft-lb shock test, the company says.

The unit incorporates a number of meter design features that are believed by the company to be "firsts" in the instrument industry. These features, plus several new manufacturing processes, were originally developed to permit high-volume production of the meter at a low unit cost for a government contract.

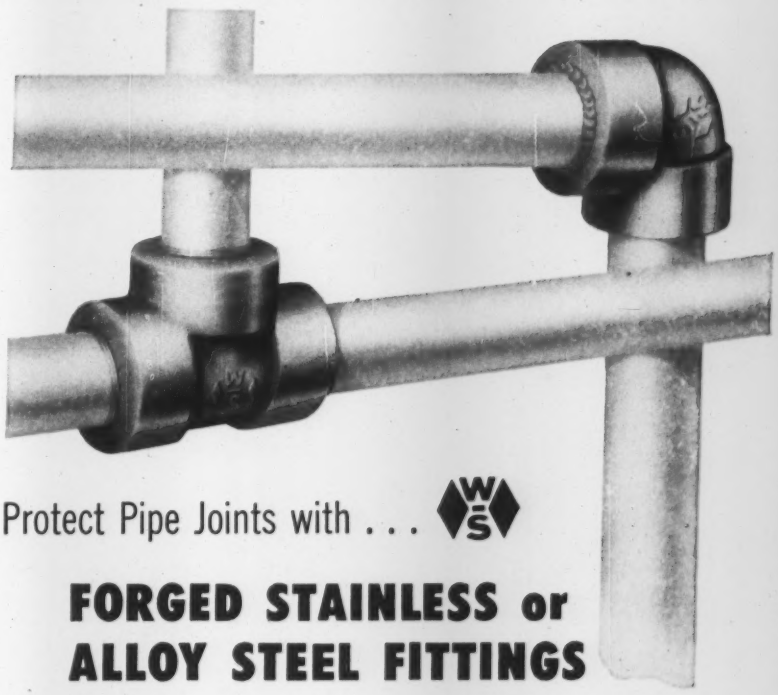
The lens, flange and case of the new meter are included in a one-piece molding of clear butyrate plastic. This design produces a meter that is completely sealed from the front. The only possible leakage point, around the zero adjuster, is rubber gasket-sealed. The butyrate is treated with antistatic compound to prevent static charges from disturbing the meter readings.

Shock mounting and adequate sealing for most usage are provided at the rear of the barrel by making the entire base of molded 90 durometer rubber, upon which the meter movement is mounted. The base end of the plastic barrel is sealed to the beveled edge of the rubber by a special process that eliminates screws or other fasteners.

The new meter is being offered in quantities of 1000 or more, in order to maintain the low price possible with large production.

Dimensions of Model 253-E include the following: OD of the flange is 2.69 in. Arc length is approximately $1^3/_4$ in., with an arc radius of $1^1/_8$ in. Mounting is per MIL-M-6A for $2^1/_2$ in. meters. Combined depth of flange and lens is $^3/_8$ in., with the barrel extension to the rear of the flange .900 in. The 8-32 studs project another $^1/_2$ in.

When **HEAT** or **CORROSION** Add to Your Pressure Piping Problems . . .



Protect Pipe Joints with . . . W-S

FORGED STAINLESS or ALLOY STEEL FITTINGS

IN CORROSIVE SERVICE your pipe joints take a beating—fluid velocity and turbulence accelerate corrosion wherever there is a change in direction of flow.

AT HIGH TEMPERATURES structural changes in the metal can cause loss of strength and subsequent failure.

Those are good reasons for "playing it safe" in high pressure service with W-S Forged Stainless or Alloy Steel Pipe Fittings. W-S Stainless Fittings resist corrosion in a wide variety of process liquids and gases and high temperature steam. Available in Types 304, 316 and 304 L.

W-S Alloy Steel Fittings resist oxidation and graphitization and retain their high strength in high pressure–high temperature steam lines. Three alloys available—1¼% Chrome-½% Molybdenum and 2¼% Chrome-1% Molybdenum and 4-6% Chrome-½% Molybdenum.

W-S Forged Stainless and Alloy Steel Fittings can be obtained in Screw-End Type for 2,000 lb., 3,000 lb., and 6,000 lb. WOG service; Socket-Welding Type for Schedules 40, 80, 160 and Double-Extra Heavy Pipe. Send today for bulletin S-1-55.

Write to W-S Fittings Division, H. K. Porter Company, Inc., P.O. Box 95, Roselle, N. J.

HKP W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.

To the *creative* engineer...

AiResearch two stage lightweight gas turbine compressor provides pneumatic power for aircraft main engine starting and serves as auxiliary power source for a variety of ground and in-flight services.

The rapid scientific advance of our modern civilization is the result of new ideas from creative minds that are focused on the future. Our engineers not only have ideas but have the ability to engineer them into products.

That's why The Garrett Corporation has grown in both size and reputation to leadership in its areas of operation. That's why we are seeking more creative engineers to help us maintain and extend our leadership. If you fall in that category, you'll find working with us fulfilling in stimulation, achievement and financial rewards.

All modern U.S. and many foreign aircraft are Garrett equipped. We have pioneered such fields as refrigeration systems, pneumatic valves and controls, temperature controls, cabin air compressors, turbine motors, gas turbine engines, cabin pressure controls, heat transfer equipment, electro-mechanical equipment, electronic computers and controls.

We are seeking engineers in all categories to help us advance our knowledge in these and other fields. Send resume of your education and experience today to: Mr. G. D. Bradley

THE GARRETT CORPORATION

9851 S. SEPULVEDA BLVD., LOS ANGELES 45, CALIFORNIA

DIVISIONS:

AIRESEARCH MANUFACTURING, LOS ANGELES • AIRESEARCH MANUFACTURING, PHOENIX

AIRESEARCH INDUSTRIAL • REX • AERO ENGINEERING

AIRSUPPLY • AIR CRUISERS • AIRESEARCH AVIATION SERVICE

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Rubber Adhesives

Special Products Div., Lord Mfg. Co., 1635 W. 12th St., Erie, Pa., has developed Chemlok 220 and 201 for rubber-to-metal bonding. New polymeric materials and chemical reactants have been synthesized to enable the application of certain fundamental principles established through research, the firm states.

Main advantage of Chemlok 220 is said of be its versatility in the permanent bonding to uncured natural and synthetic rubbers to metal with a one-coat application. One coat of this new adhesive is said to produce a bond of greater strength than that obtained with conventional two-coat adhesives with comparable environmental resistance. Superior bond resistance to adverse conditions, such as wide temperature variations, hot and cold water, salt spray, chemicals, solvents and corrosive atmospheres is obtained by using Chemlok 201 as a primer with Chemlok 220.

The company says the new adhesives will bond natural rubber, GRS, neoprene, Buna N, and butyl to carbon or alloy steel, stainless steel, aluminum alloys, magnesium alloys, copper, brass, die casting alloys, plated metals and rigid plastics. Metal surface preparation may be considerably simplified in many instances.

According to the company, chemlok may be applied to the metal parts at room temperature by brushing, spraying, dipping or rolling. The resultant surface is nontacky and resistant to wiping in molding operations. Adhesive coated metal parts may be stored up to four weeks before further processing without affecting the quality of the bond. Shelf life of Chemlok 220 and 201 is said to be at least one year.

Dual Relief Valves

New line of hydraulic relief valves engineered to relieve shock pressures that occur at control valves or motors has been developed by Fluid Controls, Inc., Mentor, Ohio.

Available in either guided piston or differential piston types, these valves are designed to protect hydraulic components and systems from excessive pressures that occur when control valves are suddenly reversed or blocked or when an external load is applied to a motor. They also assure smooth, safe starting and deceleration of heavy loads, the company claims.

The units consist of two adjustable relief valves integrated into one body. Each valve relieves in one direction and can be adjusted to the same pressure or to different pressures. When oil pressure exceeds desired setting, oil is relieved from the line and directed into the other line thereby eliminating the necessity for a connection to the system reservoir. Usually it is necessary to relieve only a small quantity of oil to prevent dangerously high pressures, the firm states.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Sight Flow Indicator

George W. Dahl Co., Bristol, R. I., announces the development of its new sight flow indicator, a combination header and "Demi" toggle valve for tight shut-off.

According to the firm, the assembly is used to indicate leakage flows, or any flow which is small and requires constant checking. Since the valve toggles shut in one plane, open or closed position is positively indicated by a distinctively colored ball, the company reports.

A variation of design is used on purge systems, with a minute 200-to-1 rangeability needle valve being used for throttling. Flow range available is 0–2 scfh. A variety of barstock materials is also available.

Power Steering Pump

A new belt-driven oil-hydraulic power steering pump designed for 1957 passenger car and truck production is now available from Vickers Inc., Box 302, Detroit 32, Mich.

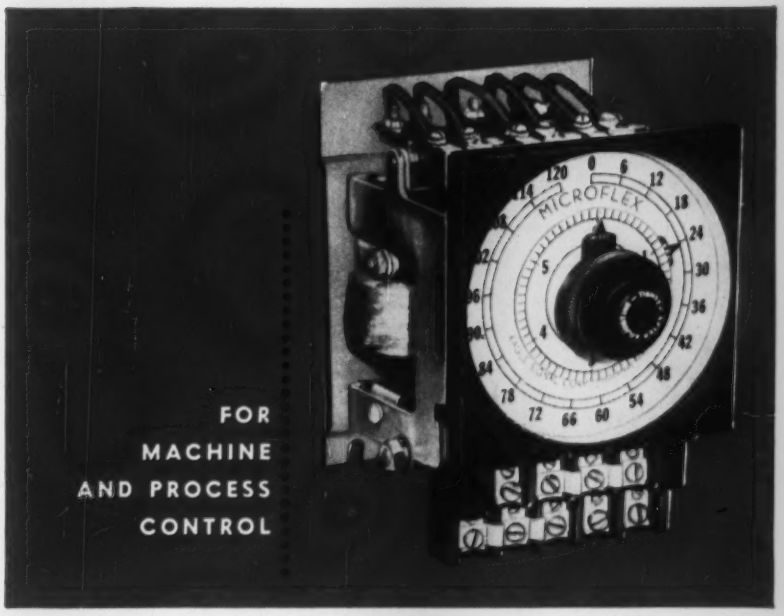
The compact, lightweight unit features a pressure lubricated sleeve type bearing in place of a ball bearing as used on previous production designs.

Designated Model VT-27, the new vane type pump utilizes an integral regenerative supercharged system which permits operation of the pump to speeds of 7150 rpm. According to the company, an outstanding design feature of the new pump is interchangeability of the rotating group, giving dual capacity to the VT-27 package. It can use either a 4 or 5 gpm insert type ring. Capacity is rated at 1200 rpm.

The pump measures $3^{7}/_{16}$ in. housing length and $6^{3}/_{8}$ in. over the shaft. The new unit weighs $10^{1}/_{2}$ lb exclusive of pulley and bracket.

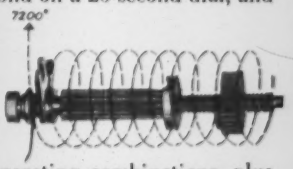
The pump also contains a supplemental flow control feature which is integral with the pump housing. This device is said to provide a flat delivery curve through the nor-

EAGLE
Microflex Reset Timer



Accurate to 1 Part in 1200

Time settings of pinpoint accuracy are a reality, thanks to the Microflex double dial. It takes one complete turn of the *inner* dial to advance the *outer* dial just one division. That's a 20-to-1 ratio, made possible by the patented Microflex threaded axle and pinion (see sketch). Examples of resultant accuracies are ± 1/60 of a second on a 20-second dial, and ± 1/10 of a second on a 120-second dial.



The Microflex Reset Timer is driven by a heavy-duty industrial synchronous motor. Contacts are tripped closed or open after a preset time interval. Starting and resetting are electrically controlled. Microflex offers over 150 timer operating combinations, plus a wide range of long or short time periods. It's ideal for applications like molding presses, dielectric heating, automatic mixing, die casting machines, machine tools and rubber curing.

Write for free Bulletin 110.

MAIL COUPON TODAY

EAGLE SIGNAL CORPORATION
Industrial Timers Division, Dept. ME-157
MOLINE, ILLINOIS

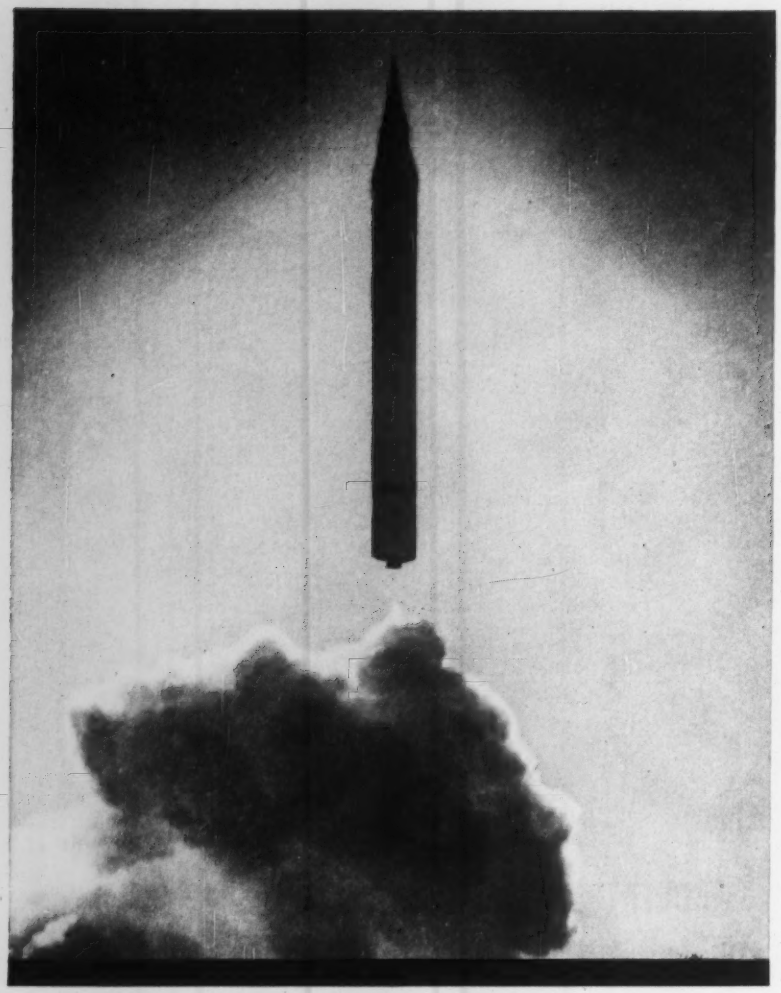
Please send free Bulletin 110 containing complete data on Microflex Reset Timers.

NAME AND TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



ceiling: ∞
subject: **PROPULSION**

From Mach 2 speeds to photon physics...from jet propulsion to nuclear-powered flight...Martin propulsion engineering problems offer the widest range of challenge and opportunity in the aircraft industry today.

If challenge is your dish and the sky is your limit, why not put this to the test?

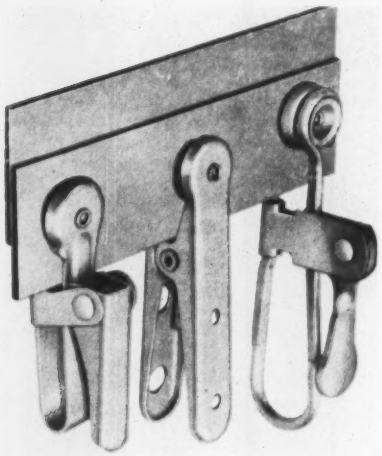
Contact J. M. Hollyday, Dept. ME-1, The Glenn L. Martin Company, Baltimore 3, Maryland.

MARTIN
BALTIMORE

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

mal operating speeds with diminished delivery at high speeds, where system requirements are lower, thereby resulting in less power loss and cooler system operation.

The unit has a 27-cu in. external reservoir mounted on top of the pump housing. Special brackets permit adaptation of the pump to a variety of engine installations. The mounting bracket contains provisions for adjustment of belt tension. Pressure connection is SAE inverted flare-type fitting for $^{3}/_{8}$-in. diam hose; return connection is for clamp-on hose.



Multi-Purpose Clamp

Wedgelock Corp., Dept. 1-R, 5446 Satsuma Ave., North Hollywood, Calif., has announced addition of an improved multi-purpose Yates industrial handy clamp to the company's line.

The clamps have been designed for a variety of uses throughout industry, both aircraft and general. According to the company, in a matter of seconds an operator can apply the clamps to metal parts, plastics, templates, molded parts, fabrications or films as they pass through the assembly line. These clamps are particularly useful for dipping, flange work, edge work, bench or wall use, the firm states. Basically there are four types of clamps: flat spring-steel clamp with cam lever lock; spring grip clamp (clothes pin type); spring wire clamp with cam lever lock and the conveyor clamp with 3 prong saw-tooth steel jaws (stationary or swivel) with cam lever lock. With the exception of conveyor clamp, all are equipped with rubber jaws.

The flat spring-steel clamp has an over-all length of $2^{1}/_{8}$ in. and clamping capacity of 0 to $^{5}/_{32}$ in.; spring grip clamp is $2^{5}/_{8}$ in. long with a clamping capacity of 0 to $^{5}/_{16}$ in.; spring wire clamps available from $3^{1}/_{4}$ to $4^{3}/_{8}$ in. long, with a clamping capacity of 0 to $1^{3}/_{4}$ in.; conveyor clamps available in $7^{1}/_{4}$, $3^{3}/_{4}$ and $2^{5}/_{8}$ in. lengths; 0 to $^{1}/_{4}$ in., and 0 to $^{1}/_{8}$ in. clamping capacity, respectively.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Voltage Generators

A new line of random voltage generators, producing low frequency noise with precisely controlled power frequency spectra and predetermined amplitude probability characteristics, has been released by the Sigmatron Div., Intercontinental Dynamics Corp., 170 Coolidge Ave., Englewood, N. J.

The generators are designed to provide ultrastable, accurate statistical functions for computer analysis, missile system analysis, instantaneous servo transfer function derivation, radar countermeasure studies, as a driving source for truly random vibration and shaker testing, and for general low frequency noise analysis purposes.

Available in six different models covering the frequency ranges from .01 to 50, 1000, 3000 and 5000 cycles, and to 1 and 5 megacycles, the random function generators provide noise signals whose amplitude distribution with time is accurately Gaussian, at an output level of 5 v rms into 600 ohms with direct reading calibrated attenuation.

White noise is produced having power frequency spectra flat within 1 db for all frequency ranges. Chopper stabilization limits its distribution drift about the mean (DC) to within ± 2 mv per hr. Total distortion in amplitude distribution is less than 2 per cent. Residual hum level is more than 70 db below the rms value of the noise signal. Multi-band range coverage is available in all models. Modular construction techniques are used throughout and sub units plug in from front panel. They are equipped with relay rack mounting.

Centrifugal Pumps

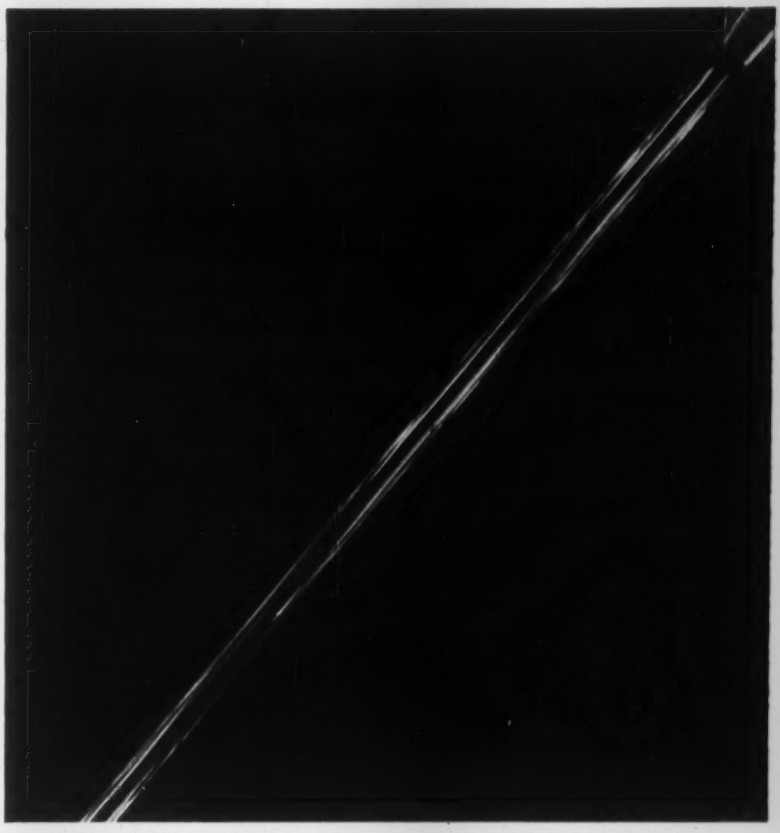
Close-coupled centrifugal pumps, Fig. 3642 and Fig. 3643, have been developed by Goulds Pumps, Seneca Falls, N. Y., for air conditioning, booster, condensate service. The units are of the single-stage, enclosed impeller type.

The motor and pump are a single complete unit. Close-coupled construction is said to assure permanent alignment of rotating parts. No coupling is required.

Once the pump is primed, the company says, the mechanical seal is fully protected from running dry. The seal prevents leakage, does not bind the shaft or require any adjustment or periodic maintenance, the firm claims.

Discharge may be located in any one of eight positions, with drain, vent and priming openings provided. The balanced impeller is the only moving part. Because the casing is vertically split, inspection and maintenance may be made without disturbing piping connections, the firm states.

Fig. 3642 is available in 1 and $1^1/_4$ in. sizes with motors from $^1/_4$ hp to 2 hp and capacities up to 100 gpm. Fig. 3643 is available in $1^1/_2$ and $2^1/_2$ in. sizes with 3 hp to $7^1/_2$ hp motors for capacities up to 350 gpm.



Using stop motion, photographer Bernard Hoffman 'freezes' a tiny jet of water. Discharged at high pressure, the stream is a solid, unwavering mass.

Controlling Pressure in Fluid Engineering

Pressure is always a problem . . . either how much you need, or what you can do in spite of it. Accurate control requires the relation of other factors, like volume, time, and resistance. To get these answers, you can depend on the engineering leadership of S. Morgan Smith.

Take butterfly valves. Parts for a wide range of standard R-S Butterfly Valves, capable of satisfying most processing requirements, are carried in stock for fast assembly and shipment. These R-S Valves, with their streamlined vanes, give you minimum pressure drop, save pumping power. Regulation and closure are quick, and you get uniform flow control through all positions in the normal regulating range.

To obtain full information on the complete SMS line – R-S Butterfly Valves, Rotovalves or Ball Valves – call our nearest representative. Or, write S. Morgan Smith Co., York, Pa., for data on standard valves or special applications.

S. MORGAN SMITH HYDRODYNAMICS

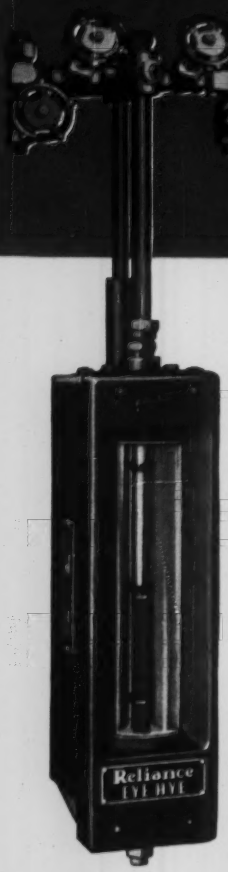
AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

Sharp visibility for *all* your liquid levels with

EYE-HYE®

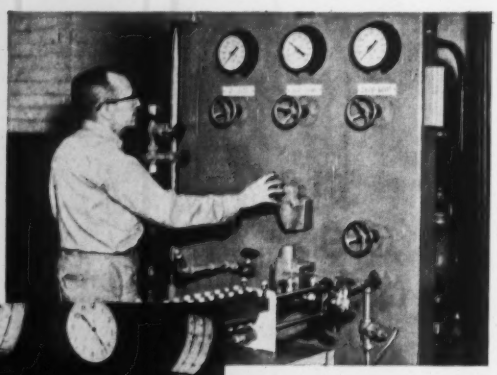
Remote Reading Gage



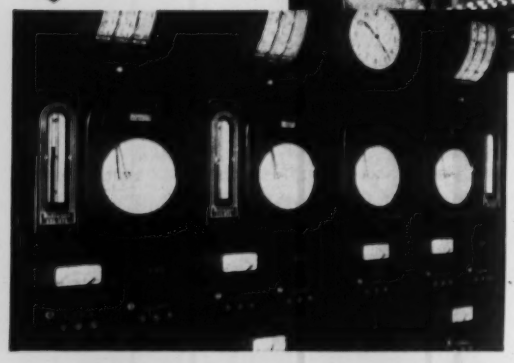
Most important for quick-reading mistake-proof gage equipment are your main boilers — naturally! But other liquid levels need watching — some that can't have "main floor" prominence or convenience.

EYE-HYE brings *all* gage reading out front, to a central point or to locations frequently passed by operators. (See list below.)

Simple, fool-proof, easy to read (illuminated green liquid represents water level), EYE-HYE is made for pressures up to 2500 psi — water level variation to 12 feet. New wide vision face plate makes reading visible from wide area. Write for specific recommendations to bring your gage facilities up to date.



Close-up of panel board section at an important research center where 3 EYE-HYEs serve the main boilers.



How EYE-HYE assemblies get hydraulic test at nearly twice their cataloged pressure rating.

Main boilers **Flash tanks**
Feed Water Heaters
Water treatment systems
Waste heat boilers
Storage tanks

The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

Reliance EYE-HYE
Remote Reading Gage
All-hydrostatic • Reads like a tubular glass gage

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Automatic Serial Numbering

Machine Tool Div., Cadillac Stamp Co., 17315 Ryan Rd., Detroit 12, Mich., announces a completely automated serial numbering machine.

Following previous operations, this machine receives transmissions over a roller conveyor which, by gravity, delivers the parts to position against the spring cushioned stop where, on contact, a micromatic switch starts the automatic marking operation.

Cases are then moved to the numbering head which performs the serial numbering operation, after which the ejector pushes marked cases onto another roller conveyor, over which the part travels to rejoin its cycle of manufacture. According to the company, automated marking operation is performed in six seconds.

Retractable Soot Blower

A long retractable soot blower, designated Vulcan T-30, developed by Copes-Vulcan Div., Blaw-Knox Company, Erie, Pa., is designed for very wide furnaces and has been built for traverse travels in excess of 36 ft. According to the firm, it is suited for outdoor installations in northern climates. It can use either air or steam, with nozzle pressures from 50 to 425 psig, as the blowing medium without change in equipment. Dynamic balancing of the nozzles prevents vibration and whip of the lance during operation, the company states.

The unit uses two electric motors, one to extend and retract the lance, and one to rotate it for a clean sweep of the tubes in all directions. Different speeds are available for both movements.

Rotation of the lance is always in the same direction. According to the company, this, together with a change in retraction path, forms an infinite number of double-helix patterns of the blowing medium on repeated cycles to clean all surfaces uniformly and to minimize the danger of tube cutting.

The alloy lance is said to have exceptional strength at elevated temperatures. The stainless steel feed pipe is ground and polished to prevent binding and wear as the carriage slides along it, even with steam at 750 F. The continually-changing path of the jets minimizes cutting or eroding, the company says, and the feed pipe and lance have no hidden parts to clog or corrode, or to retard travel of the blowing medium. The exposed stuffing box can be easily repacked.

Motors are located away from hot furnace gases. Gear trains and controls are mounted away from the boiler walls and out of the path of the blowing medium. The low-friction chain drive is claimed to need little lubrication, is self-cleaning and is easily inspected and maintained.

A hardened-steel scraper plate, installed adjacent to the boiler wall, removes deposits while the lance is retracting.

Continued on Page 57

Need more engineering information on products advertised in this issue?

USE THE POSTAGE-FREE CARDS . . .

If you would like further engineering information on any of the products advertised in this issue, circle the page numbers of these ads on one of the cards below . . . fill in your name and address and mail to us. Your requests will be forwarded to the advertiser. The information will come directly to you.

(Note: This service does not apply to students.)

MAIL THIS CARD ▶

after circling the page numbers and filling in your complete address.
NO POSTAGE REQUIRED

FIRST CLASS
PERMIT No. 1144
NEW YORK, N. Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

3c POSTAGE WILL BE PAID BY

MECHANICAL ENGINEERING
29 West 39th Street
New York 18, N.Y.

MECHANICAL ENGINEERING—JANUARY 1957 issue

IFC	16	29	45	67	81	91	107	123	135TL	167
1	17	30	46	69	83	93	108	125	135BL	169
2	18	31	47	71R	84	94–95	109	127	135R	IBC
3	19	32	49	72L	85	97	111	128–29	136L	OBC
4–5	20–21	33	51	73	86L	98	113	130	136TR	
6–7	22–23	34	53	74T	86TR	99	115	131	136BR	
8–9	24	35	54	75	86BR	101	117	132–33	137–38	
10–11	25	37	57	76L	87	102	118	134TL	139	
12	26	40	59	78L	88L	103	119	134BL	140–41	
13	27	42	62T	78R	88R	105	121	134TR	143	
14–15	28	43	65	79	89	106	122	134BR	165	

When more than one advertisement appears on a page, the following code identifies the location of the ad on page: T-top, B-bottom, L-left, R-right, IFC-inside front cover, IBC-inside back cover, OBC-outside back cover.

PLEASE SEND me more complete engineering information on the products advertised in the pages circled above.

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

CITY and STATE.....

Need more engineering information on products advertised in this issue?

USE THE POSTAGE-FREE CARDS . . .

If you would like further engineering information on any of the products advertised in this issue, circle the page numbers of these ads on one of the cards below . . . fill in your name and address and mail to us. Your requests will be forwarded to the advertiser. The information will come directly to you.

(Note: This service does not apply to students.)

MECHANICAL ENGINEERING—JANUARY 1957 Issue

IFC	16	29	45	67	81	91	107	123	135TL	167
1	17	30	46	69	83	93	108	125	135BL	169
2	18	31	47	71R	84	94–95	109	127	135R	IBC
3	19	32	49	72L	85	97	111	128–29	136L	OBC
4–5	20–21	33	51	73	86L	98	113	130	136TR	
6–7	22–23	34	53	74T	86TR	99	115	131	136BR	
8–9	24	35	54	75	86BR	101	117	132–33	137–38	
10–11	25	37	57	76L	87	102	118	134TL	139	
12	26	40	59	78L	88L	103	119	134BL	140–41	
13	27	42	62T	78R	88R	105	121	134TR	143	
14–15	28	43	65	79	89	106	122	134BR	165	

When more than one advertisement appears on a page, the following code identifies the location of the ad on page: T-top, B-bottom, L-left, R-right, IFC-inside front cover, IBC-inside back cover, OBC-outside back cover.

PLEASE SEND me more complete engineering information on the products advertised in the pages circled above.

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

CITY and STATE.....

FIRST CLASS
PERMIT No. 1144
NEW YORK, N.Y.

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

3c POSTAGE WILL BE PAID BY

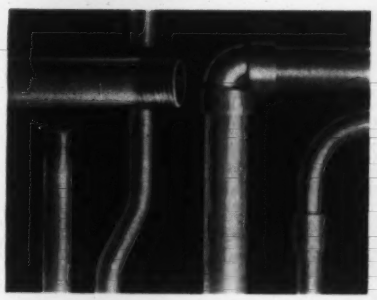
MECHANICAL ENGINEERING
29 West 39th Street
New York 18, N.Y.

MAIL THIS CARD

after circling the page numbers and filling in your complete address.
NO POSTAGE REQUIRED

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS



Rigid PVC Pipe

Rigid unplasticized PVC pipe is now available in all standard pipe sizes from 1/4 to 6 in.; according to announcement by the manufacturer, Easton Plastic Products Co., Inc., Easton, Pa.

The company says the pipe offers excellent resistance to corrosion and to most chemicals, including acid, alkaline, and salt solutions, alcohols, and gases. Chemically inert, it maintains absolute purity of materials carried, including water and foods for human consumption. It has been approved by the National Sanitation Foundation for use with drinking water.

The firm states that the PVC pipe and tubing is precision-sized to close tolerances, and is dimensionally stable. Easily worked and assembled, it can be sawed, threaded, welded, cemented, machined, and formed with conventional equipment. Its weight is only half that of aluminum, one-sixth that of steel; it has high structural strength and a tensile strength of 5500 to 7000 psi, the company says.

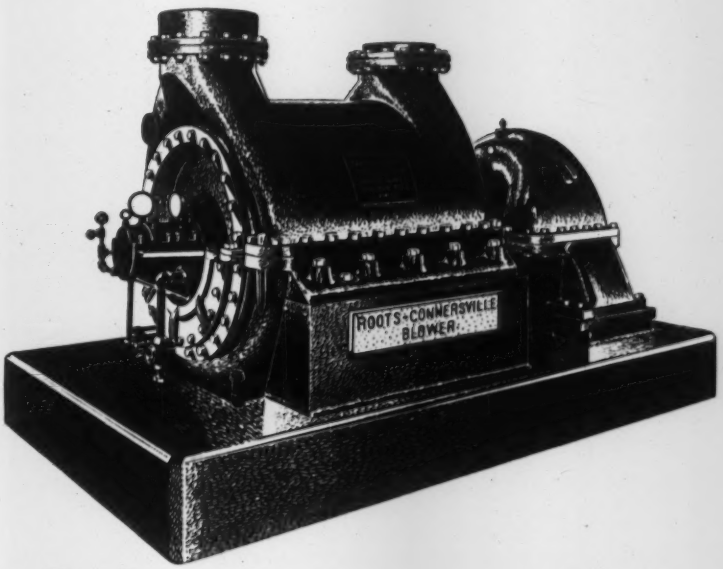
Temperature Regulator

Designed to withstand the corrosive effects of certain fumes, gases, acids, and chemicals, a new stainless steel temperature regulator is now offered by Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville, Tenn.

According to the company, the new regulator, called the No. 11061-R, was developed mainly for use in chemical plants. Other applications seen for the regulator are in plating rooms and in processes where ammonia vapors are present. It is also recommended by the firm for exposed locations.

In standard models of this control the entire upperworks are of stainless steel. The company says, it will supply valves, as well as upperworks in stainless steel, for use in extremely corrosive situations. The No. 11061-R is available in sizes from 1/4 to 4 in. and in temperature ranges between 20 and 455 F.

The new unit requires no external power source, such as compressed air, water or electricity to function efficiently, the company says. A large stainless steel bellows is used in the thermal unit to provide accurate and sensitive control over temperature.



R-C centrifugal blowers assure accurate control of volume and pressure

At any speed, Roots-Connersville centrifugal blowers assure uniform delivery of air or gas without the use of receivers. In matching supply to changing demand, this inherent operating advantage simplifies accurate and instantaneous control of volume and pressure.

R-C centrifugals may be direct-connected to high speed electric motors or turbines. Operating speeds may be further raised with speed increasing gears. Occupying a minimum of space and perfectly balanced, with semi-rigid bearing supports to dampen vibration, they do not require special, costly foundations.

Liberal design of diffuser and return passages results in low velocities, normal efficiency even when build-up occurs and exceptionally quiet operation. Operating without internal lubrication, oil-free air is discharged, making it ideally suited for exacting process applications. For complete specification details, write for Bulletin 120-B-14.

Engineers—unusual career opportunities await you at Roots-Connersville. Address your resume to Professional Employment Manager.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

157 Michigan Avenue, Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto, Ont.

ANALYTICAL ENGINEERS

At Hawthorne, in Southern California, Northrop Aircraft has a continuing need for experienced engineers seeking new opportunities. There are attractive positions open in the following fields: Aerodynamics, Dynamics, Thermodynamics, Stress, Loads, Performance Analysis.

In Northrop's superbly equipped multi-million-dollar engineering and science center, now nearing completion, you will be given constantly fresh and challenging assignments. Present programs include Northrop's new supersonic trainer airplane, the Snark SM-62 intercontinental guided missile, plus advanced aircraft and missile projects yet to be revealed.

You'll be associated with a high-calibre engineering team that has established an outstanding record in aeronautical design and development. Your initiative and ideas will be recognized, encouraged and rewarded, for at Northrop Aircraft the progress of personnel is as important as the progress of projects.

Besides attractive remuneration, you will enjoy other benefits unexcelled in the entire industry—retirement plans, health and life insurance, college educational reimbursement plan, regular vacations plus extra year-end vacations with pay. Easily-reached mountain, desert and beach resorts in sunny Southern California offer year 'round attractions for you and your family.

You will find the career opportunity you are seeking at Northrop, pioneer in the design and production of all weather and pilotless aircraft. If you qualify for one of these attractive positions, contact the Manager of Engineering Industrial Relations, Northrop Aircraft, Inc., ORegon 8-9111, Extension 1893, or write to: 1015 East Broadway, Department 4600- D, Hawthorne, California.

NORTHROP

NORTHROP AIRCRAFT, INC., HAWTHORNE, CALIFORNIA

Producers of Scorpion F-89 Interceptors and Snark SM-62 Intercontinental Missiles

8-A-89

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

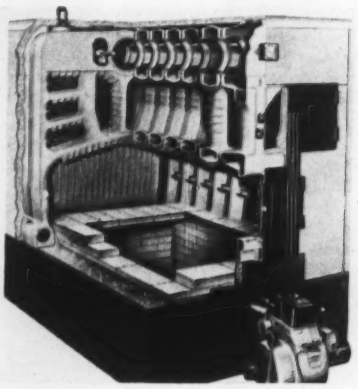
Flange Union

Almar Hydraulic Valve Co., 10011 Meech Ave., Cleveland 5, Ohio, announces a new flange union with socket weld connections.

The union is designed to withstand high operating pressures (to 3000 psi for schedule 80 pipe) and special unions incorporating the same design can be provided to withstand pressures up to 10,000 psi, the firm states.

Features of the union include a true-ball seat and revolvable flanges. The true-ball seat is said to assure leak-proof sealing even when there is a considerable misalignment of pipe. The revolvable flanges, on the other hand, make assembly much easier because bolts and bolt holes are readily placed into position, the company says. The union can be reassembled many times and still retain its original sealing qualities.

The new flange union is available for pipe sizes ranging from $\frac{1}{8}$ to 6 in.



Cast Iron Boilers

To eliminate multiple installations of small boilers when providing adequate hot-water or low-pressure steam for heating industrial plants, institutions, hotels, motels, larger retail stores and other commercial structures, National-U. S. Radiator Corp., Johnstown, Pa., has marketed a new series of large cast iron boilers and boiler-burner units.

The 47 series is the identification given to both the 10 sizes of cast iron boilers, and the eight oil heating units which comprise boiler, oil burner, and pertinent accessories.

The manufacturer states that each of the 47 series cast iron boiler sections has 77 finger-like projections which form extra heating surface within flue passes and on the firebox crown. Large nipple ports, says the boiler maker, provide free and uniform water flow between sections. Ground raised beads provide iron-to-iron contact between the sections. Doors also are ground to fit tightly against machined seats, explains the company.

The burners, supplied as a major component of the boiler-burner units, are of the high

pressure atomizing type. These gun type burners are claimed to be the design of burner most familiar to installers and service personnel.

Domestic hot water can be secured from the boiler or the unit when equipped with tankless or storage tank heaters. Both the 47 series boiler, and the 47 series boiler-burner unit, are marketed with a silver green enameled jacket which encloses a complete wrapping of glass wool blanket insulation. The new products meet ASME boiler code construction, and are I-B-R rated.

The cast iron boiler net I-B-R ratings range from 2500 sq ft to 7600 sq ft for steam, and from 4145 sq ft to 12160 sq ft for water. The boiler-burner unit has net I-B-R ratings for the eight models that extend from 2500 sq ft to 6400 sq ft for steam, and from 4145 sq ft to 10240 sq ft for water.

Power Roof Ventilators

A new line of propeller type power roof ventilators with certified ratings is available from American Blower Corp., Detroit 32, Mich.

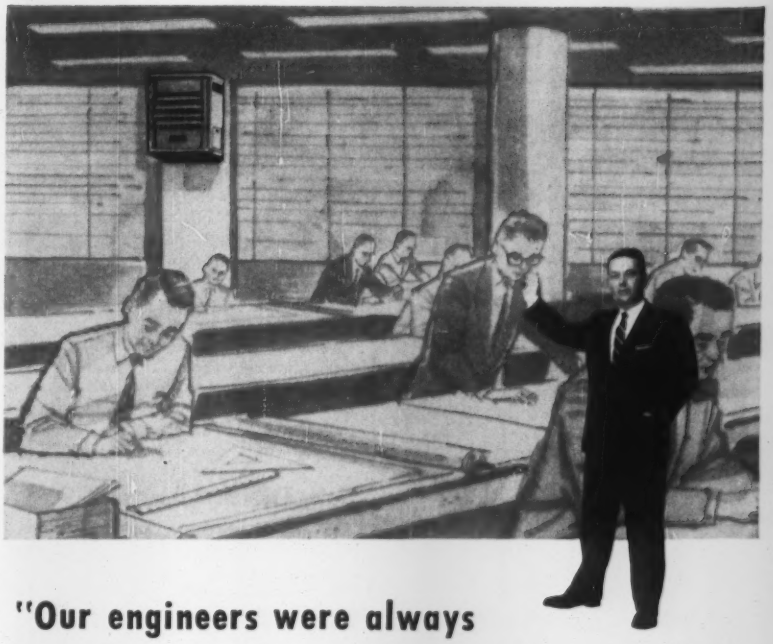
The new units feature a redesigned fan wheel said to produce optimum efficiency when operating within the type of enclosure formed by a power roof ventilator housing.

The certified line includes four models. These are the upblast type exhaust ventilator, the hood type exhaust ventilator, the hood type supply ventilator and the air intake hood. All models feature heavy-gage welded steel construction. All surfaces are phosphatized for rust resistance and have a baked enamel finish. Each model is provided with a flanged base for easy curb mounting. The hood types are completely weatherproof.

Designated Model VRV, the upblast type exhaust ventilator includes a belt driven fan and is designed especially for exhausting corrosive, oil or grease-laden fumes. Air is discharged above the roof at high velocity by this ventilator design. Thus, impure exhaust air is expelled high enough above the roof to prevent re-entry into supply ventilators. Model VRV is available in 16 standard sizes for certified rated deliveries up to 52,200 cfm (measured at zero static pressure) or 48,500 cfm (at $^1/_8$-in. wg static pressure).

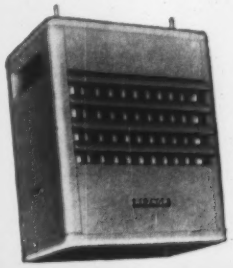
The new hood type exhaust ventilator, Model HRV, is provided with a durable, weatherproof exhaust hood. The hood offers low resistance to air flow. The fan is belt driven. Model HRV is available in 21 standard sizes having certified ratings up to $^1/_2$-in. wg static pressure. Rated deliveries for the largest size are 31,500 cfm at zero static pressure and 24,500 cfm at $^1/_2$-in. static pressure.

Model SSV, hood type supply ventilator with belt driven fan is recommended by the company for applications requiring supply air during summer months, or for applications where the climate does not require the tempering of cold outdoor air. It is available in 20 standard sizes providing certified



"Our engineers were always complaining about the cold until we installed Reznor heaters in the drafting room"

"Our steam heating system does a good job out in the plant where temperature levels don't need to be as high or as steady, but we've always had trouble keeping office workers comfortable. So we installed these Reznor gas unit heaters in the drafting room. It worked out so well we're using Reznor heat in all office areas now. Reznor heaters are doing a better job for us in these areas because they respond instantly, automatically to the temperature requirements of their immediate surroundings. Reznor suspended units are fine here in the drafting room. In other office areas, where floor space is at less of a premium and appearance more important, we've used Reznor floor models. We even installed them in the executive offices, and they've helped sell management on Reznor heating."



Only Reznor Gas Unit Heating Offers All These Advantages

- Low Equipment Cost
- Low Installation Costs
- Low Operating Costs
- Instant Response to Every Change in Temperature
- No Maintenance Problems
- Wastes No Floor Space
- Extra Heat for Trouble Spots
- Complete Adaptability to Future Construction

For more information mail the coupon below or call your nearby Reznor distributor. He's listed under "Heaters-Unit" in the yellow pages of your telephone directory.

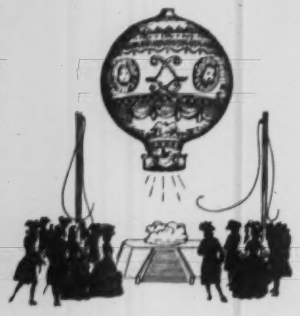
REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT HEATERS

REZNOR MANUFACTURING COMPANY
71 Union Street, Mercer, Pa.

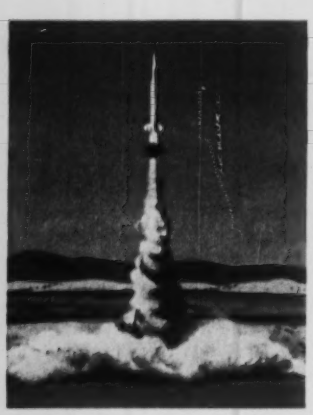
☐ Please send me my free catalog on Reznor gas heating equipment.
☐ Please have a representative call to discuss our plant heating problems.

Name..... Title.....
Company.....
Street.....
City..... State.....

MECHANICAL ENGINEERS



Stimulation, status, security . . . the absorbing challenge of the rocket propulsion field, the rewards of professional recognition, the stability of a firmly established organization . . . are yours at Aerojet-General.



Aerojet offers experienced mechanical engineers and recent graduates unparalleled career opportunities on a variety of important problems.

Design and development of pumps, valves, control and propellant systems for huge new liquid-propellant rocket engines.
Design and testing of a variety of thrust chambers, turbines, injection systems, and servomechanisms.
Studies of ignition, combustion phenomena, heat transfer, cooling, vibration and thermal shock.
Design and development of thrust reversers for jet engines.
Design and testing of underwater jet engines and other devices.
Design of test equipment and production machinery.

Aerojet-General
CORPORATION
A Subsidiary of The General Tire & Rubber Company
PLANTS AT AZUSA AND NEAR SACRAMENTO, CALIFORNIA

Write: Director of Scientific and Engineering Personnel, Box 296BB, Azusa, Calif. or Box 1947BB, Sacramento, Calif.

KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

ratings up to 1/2-in. wg static pressure. Rated deliveries for the largest size are 37,500 cfm at zero static pressure and 30,300 at 1/2-in. static pressure.

Model WSV is the designation given to the new air intake hood design. This model does not have a supply or exhaust fan. It is used in conjunction with a centrifugal heating and ventilating unit which will provide tempered make-up air for winter supply problems. Model WSV is available in five sizes to meet the full range of industrial requirements.

Water Treatment Analysis

Rempe Co., 340 N. Sacramento Blvd., Chicago 12, Ill., announces the availability of a boiler water sampler said to prevent "flashing" when taking boiler water samples for water treatment analysis. It is suitable for boiler blowdown to 900 psi and 750 F.

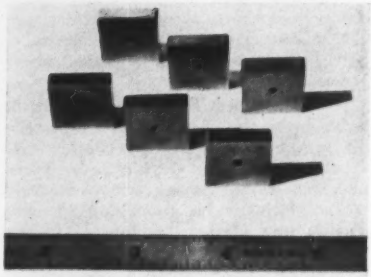
The unit may be installed in any position. Body specifications are 4 1/2 in. OD × 16 in. long. Cooling water connections are 1/2 in. ips. Sample inlet and outlet 1/4 in. ips. Cooling coil contains 30 ft of copper tubing. Flanged head is 7 in. diam complete with bolts, nuts, and gasket. Weight is 40 lb.

Rotary Hearth Oven

Grieve-Hendry Co., Inc., 1401 W. Carroll Ave., Chicago 7, Ill., has announced a rotary hearth oven designed and built to permit loading and unloading from the same position by a single operator, and at the same time to permit a continuous movement of work in and out of the heating zone.

Standard speed range is from 2 to 10 in. per min or approximately 1–5 revolutions per hr. No doors are used. The firm says an alloy steel chain curtain is used to conserve heat and provide convenient access to work chamber.

The ovens are built to individual requirements. The company says the working chamber is well insulated. Specifications include a 125,000 Btu burner, 600 cfm heavy duty steel plate recirculating blower, adjustable dampers on fresh air intake and exhaust outlet, indicating temperature controller, combustion safety controls with push button electric ignition. Pilot lights show that hearth drive, blower and heater circuits are energized.



Throw-Away Blanks

For what is said to be the first time in industry, a permanent system of identification on cemented tungsten carbide throw-away blanks is being used.

The Carmet Div., of Allegheny Ludlum Steel Corp., Pittsburgh 22, Pa., has announced the identification system to help eliminate high tool costs due to the mixing of various grades.

The new system will also greatly simplify the taking of inventory on carbide throw-away blanks, the firm states.

The company explains that throw-away blanks are small sections of cemented tungsten carbide which are used as the cutting edge to machine various metals and are the hardest substance made by man.

These blanks are used in special holders, which are also made by the firm, and are discarded after all their sharp surfaces have been used. Throw-away blanks eliminate the necessity of grinding new edges on cutting tools.

Throw-aways are made in six grades in the form of circles, squares, and triangles.

In the past on cutting tools, grade identification was no problem because the carbide grade was knurled on the shank of the tool, the company says. The tool had a single brazed point which stayed with it for the life of the tool.

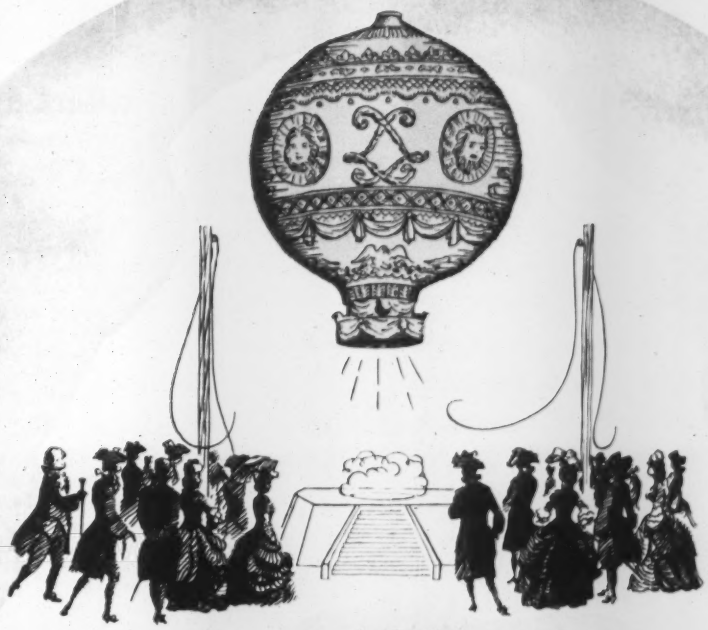
Tool room maintenance of throw-away blanks and inventory was said to be a problem because the blanks made by many manufacturers, regardless of grade, looked alike. Often, this resulted in the misuse of grades and in high tool costs and excessive scrap.

The firm presses the designation 1/64 of an inch deep into the face of the throw-away blanks.

Continued on Page 62

Let's Finish the Job!

JOIN THE MARCH OF DIMES IN JANUARY



Globe Aerostatique . . . 1783

Montgolfier's vanguard project

A sheep, a duck, a rooster—the first payload carried aloft for atmospheric research. Louis XVI, his queen and his court, were astonished witnesses as Joseph Montgolfier's smoke-filled balloon rose in majesty 1500 feet over Versailles. The passengers? unharmed (except the rooster, kicked by the sheep).

Project Vanguard, 1957, is an equally momentous "first"—an attempt to place a 21-pound satellite in an orbit 300 miles up. Aerojet-General, designer-builder of the famed Aerobee-HI, will supply vital second-stage propulsion systems for Vanguard launchings during the International Geophysical Year.

Aerojet-General CORPORATION

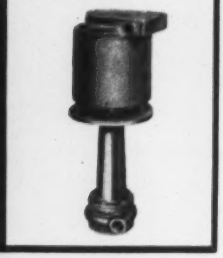
A Subsidiary of The General Tire & Rubber Company

THE GENERAL TIRE

PLANTS AT AZUSA AND NEAR SACRAMENTO, CALIFORNIA

Aerojet-General invites scientists and engineers—men of imagination and vision—to join the attack on the most significant research, development and production problems of our time.

RUTHMAN GUSHER
COOLANT PUMPS



Illustrated is a Rivett 918 Cabinet Turret Lathe equipped with a Model 1-P3—1/10 H.P. Gusher Coolant Pump

The Most For Your Money

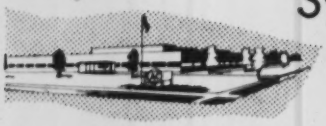
Moderate in initial cost, Gusher Coolant Pumps are pre-lubricated . . . require no packing . . . are electronically balanced . . . have no metal-to-metal contact within the impeller housing. Vibration and wear are cut to an absolute minimum. You are sure of a long trouble-free life. To save *your money* always specify Ruthman Gusher Coolant Pumps. Write for our new catalog.

THE **RUTHMAN** MACHINERY CO.

1823 Reading Road — Cincinnati, Ohio

Servo Engineers

ELECTRICAL MECHANICAL
Inertial Guidance System Program



Enjoy Challenging Opportunities in the further development and systems testing of Inertial Guidance Systems and their Servo Loops in the most versatile laboratories in the country.

Work with the top men in the field and with the finest test, research and development facilities. New plant being added in suburban Milwaukee as a part of Major, Permanent, Expansion Program.

AC will provide financial assistance towards your Master's Degree. A Graduate Program is available evenings at the University of Wisconsin, Milwaukee.

GM's long-standing policy of decentralization creates individual opportunity and recognition for each Engineer hired.

Milwaukee offers ideal family living combining small town hospitality with every metropolitan shopping and cultural advantage.

For personal, confidential interview in your locality send complete resume to

Mr. John F. Heffinger
Supervisor of Technical Employment

Recent EE, ME Graduate Inquiries Also Invited

THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
FLINT 2, MICH. • MILWAUKEE 2, WIS.

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Cabinet Dust Collector

A new cabinet-type dust collector, Model 123, designed to handle heavy-duty continuous grinding and other high dust volume sources, has been announced by Torit Mfg. Co., 287 Walnut St., St. Paul 2, Minn.

Handling as many as eight grinding wheels at a time, the unit has a dust storage capacity of 10 cu ft and a filter area of 300 sq ft. Its 5 hp motor moves approximately 2000 cu ft of air per minute through an 8 in. inlet at speeds of more than a mile a minute. Static pressure for this inlet is $3^1/_2$ in water.

The welded steel cabinet is finished in baked gray enamel, and cloth filters are chemically treated for spark resistance and sealed against leakage. Filters, motor and blowers are easily reachable through removable doors, the firm says.

According to the company, the motor is internally mounted in the clean air stream above the filters for cool, quiet and efficient operation. Manual starter with overload protection is standard equipment, while explosion-proof motors and magnetic starters are available at extra cost. If desired, the collector can be wired through the starter of the machine it serves, saving power by automatically starting and stopping with the machine. The unit is 115 in. high, $62^1/_2$ in. wide and 26 in. deep.

Tube Bending Press

A vertical ram-type tube bending press, capable of making two bends in each of two or more tubes, and able to bend two different angles in the same "U" frame, is announced by Pines Engineering Co., Inc., Aurora, Illinois.

The new press, Model 6-T, incorporates a self-contained hydraulic system built for continuous production. It has a rated capacity of 6 tons and is designed so that the full ram tonnage is available for the bending action. This is possible because the center clamp moves with the ram and the cushion pressure does not oppose the ram tonnage, the company explains.

Other design features include twin equalizing cushion cylinders, variable speeds, single adjustment for wing dies, retracting ram dies, and changeable wedge inserts for ram dies. Characteristics of the new Model 6-T make it ideal for high speed production of furniture and similar items, the firm says.

The new press may be used for bending both steel or nonferrous tubing. It has adequate power and capacity for continuous bending of 1 in. OD steel tubing with a minimum ovalization in the bend. Excessive flattening and wrinkling is said to be prevented by the operating characteristics of the new machine. Provisions have been made for very accurately aligning dies, and the wing die moves with the tube as it is wrapped around the ram die, elminating the possibility of draw marks that would otherwise be applied to the tube.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Air Grinders

Thor Power Tool Co., Aurora, Ill., has announced a new lightweight 6-in. air grinder with an improved motor said to be 50 per cent more powerful than previous models. The tool is part of the company's new No. 4 series of industrial air tools.

The new T4G series of air grinders is being produced in 12 models—four different speeds and three different throttle types. It has fewer parts and has a five-blade type motor with a one-piece rotor and shaft. It supersedes the company's 250 series.

The model is available in speeds of 4500, 6000, 9000 and 12,000 rpm and comes in butterfly, grip and lever type throttles. Friction and vibration have been reduced in the new models, company officials report. Air exhaust also has been silenced to a minimum.

Another feature in the latest models is a newly designed governor. It is a unit assembly, direct acting and tamper-proof governor with an adjustable governor spring.

The 4GG series grip type has a handle that is integral with the cylinder housing and employs a steel ball throttle valve. The 4GL series lever throttle handle is made of aluminum with a rubber sleeve for positive hand grip. The 4GB series button or butterfly type has an aluminum handle with longitudinal ridgings for firm grip. Throttle valve seats in steel bushings are made of stainless steel to prevent rusting.

All throttle types have a steel reducer bushing for hose connections. The grip type also has an automatic mist type lubricator. In the lever and button types, oil is inserted manually.

Plastic Gasket

A new plastic gasket and shim stock, color-coded to indicate the twelve different thicknesses that it comes in, has been introduced by General Gasket Co., Industrial Rd., Clifton, N. J. It is being marketed under the name of Color-Plast Gasket and Shim Stock.

Each gage of the new material is identified by its own distinctive color. The material is said by the company to be ideal for both shims and gaskets as it is processed on special machinery which holds its gage to micrometer tolerances. It is claimed to be tougher and longer lasting than conventional sealing materials and impervious to oils and greases even when they are boiling hot. The firm says it will not swell or become distorted after long use. The resiliency of the material makes the use of gasket cement unnecessary, the company says. In certain applications it may replace three thicknesses of other materials, since it serves as shim, gasket and sealer.

Applications are recommended by the company in the aircraft, marine, hydraulic, refrigeration, machine tool, and automotive industries. Color-Plast is also available in the form of die-cut shims for cup and cone adjusted tapered roller bearings.

CHALLENGE!

This is it. The call to make history. The challenge of the ICBM, Titan.

Accept it—lay your skill, courage and tough-minded determination on the line—and you'll join an engineering team dedicated to reaching another plateau in man's conquest of space.

In return, we offer you unbounded opportunities as promising as the growth of our company. We offer the deep-down satisfaction of working with top engineers. We offer the modern facilities of our plant, located in the foothills of the Colorado Rockies.

If this challenge calls you, write today to: Emmett E. Hearn, Employment Director, Dept. M-1, P.O. Box 179, Denver 1, Colorado.

MARTIN
DENVER

devoted to Research
GYRO ASSEMBLY AND TEST

Mechanical and Electrical Engineers, with a personal interest in precision mechanisms, where a high degree of accuracy is required, and a pride in the precision of the product they help build, we offer truly challenging opportunities.

You will do development work and testing in one of the country's most versatile laboratories, working with the top men in the field and the finest test, research and development equipment. As a part of our Major, Permanent, Expansion Program, new plant facilities are being added in suburban Milwaukee.

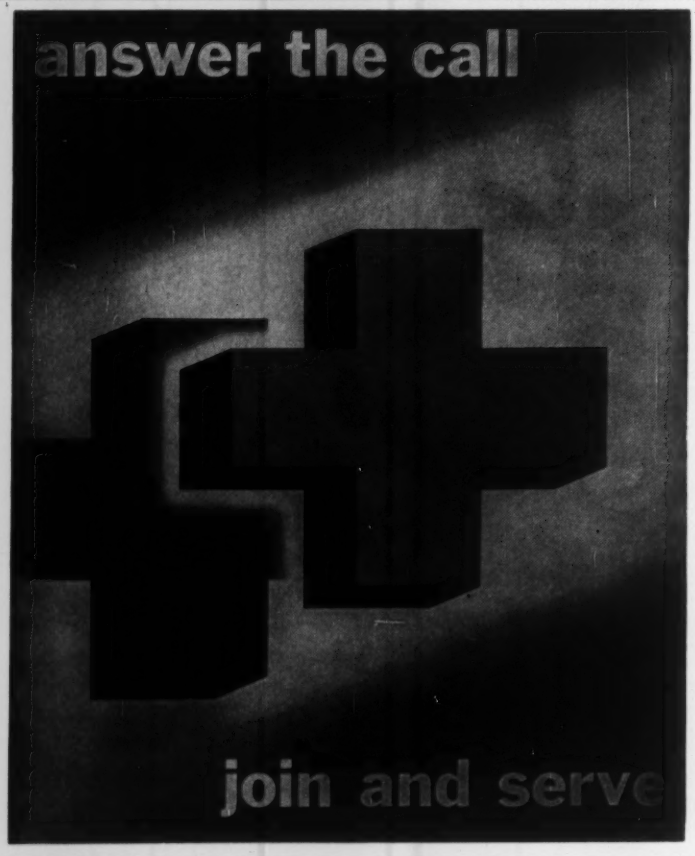
AC provides financial assistance toward your Master's Degree. Graduate program also available evenings at Univ. Wisconsin, Milwaukee. GM's aggressive position in the field of manufacture and GM's policy of decentralization creates individual opportunity and recognition for each Engineer hired.

RECENT EE, ME GRADUATE
INQUIRIES ALSO INVITED

Milwaukee offers ideal family living in a progressive neighborly community in Southern Wisconsin.

To arrange personal, confidential interview in your locality send full facts about yourself to

Mr. John F. Heffinger, Supervisor of Technical Employment
THE ELECTRONICS DIVISION
GENERAL MOTORS Corporation
FLINT 2, MICH. MILWAUKEE 2, WIS.



KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Linen Phenolic Gears

Pic Design Corp., 160 Atlantic Ave., Lynbrook, N. Y., announces that precision linen phenolic spur gears are immediately available from stock in variable pitches of 48, 64, 72, and 96; bores, 1/8, 3/16, and 1/4 in.; face width 1/8, 3/16.

The gears are cut and stocked to American Gear Mfg. Assoc., standards AGMA Proc. 1. Material is to MIL-P-15035 type FBL and finished with fungus proofed varnish before gear cutting.

Disk Thermostat

Spencer Thermostat Div., Metals & Controls Corp., Attleboro, Mass., presents a new snap-acting, disk-type thermostat for applications where maximum shock and vibration resistance are required.

The controls feature the firm's disk thermal element, fine silver electrical contacts, and a complete hermetically sealed assembly. A copper-nickel plated steel casing is designed to protect all parts from contamination and moisture to assure precise circuit operation.

Applications for the unit, called Klixon are recommended by the company in aircraft controls and guided missiles. A range of possibilities also exists in heaters, electronic circuits and components, servo mechanisms, gyroscopes, aerial cameras, gun mounts.

Standard temperature settings which are fixed, range from −20 to 400 F. The C7216 thermostat is available with No. 20 copper wire leads.

Initiates Gamma Facility

A 5500 curie, cobalt-60 source of gamma radiation has been completed at the Nuclear Div., Martin Co., Baltimore, Md.

The facility will be primarily used to test the effect of radiation on various materials. It will also be used as a pure research tool for the purpose of establishing a background of information. It is one of the first to be built entirely with private capital for the exclusive use by industry, the company reports.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Re-Rated Motors

New re-rated motors with six improvements have been developed here by Robbins & Myers, Inc., Springfield, Ohio.

The Series 254U motors, re-rated to conform with new requirements established by the National Electrical Manufacturers' Association, are said to eliminate "hot spots" through straight-through, dual-sweep ventilation. Tandem fans, one pushing and another pulling, produce a washing action and over the field coil ends to insure lower internal temperatures, the company explains.

Mylar, laminated to rag paper, is used as slot cell insulation. Removable cover plates on each end-head permit inspection without dismantling the motor, the company says. Since the bearings run in double-width races, they have extra large reservoirs containing grease to resist dust, temperature, humidity, and high operating speeds.

According to the company, installation and maintenance are simplified through permanently-numbered leads. Numbers are permanently-impregnated into the subsurface of the insulation and can't wear off or deteriorate.

One-piece, shrouded end-heads is said to give the motors full height protection against moisture and falling objects. Internal baffles complete the splashproof construction. Factory installed end-head screens are included at no extra cost.

Cabinet Fan

A new, large volume cabinet fan for operation at low noise level and space-saving installation in buildings with low ceilings has been announced by Trane Co., La Crosse, Wis.

According to the firm, the new fan can be used in air moving systems for supply, exhaust, or recirculation of air. It is available in 12 sizes ranging from 600 to 34,500 cfm, with outlet velocities varying from 1000 to 2600 fpm.

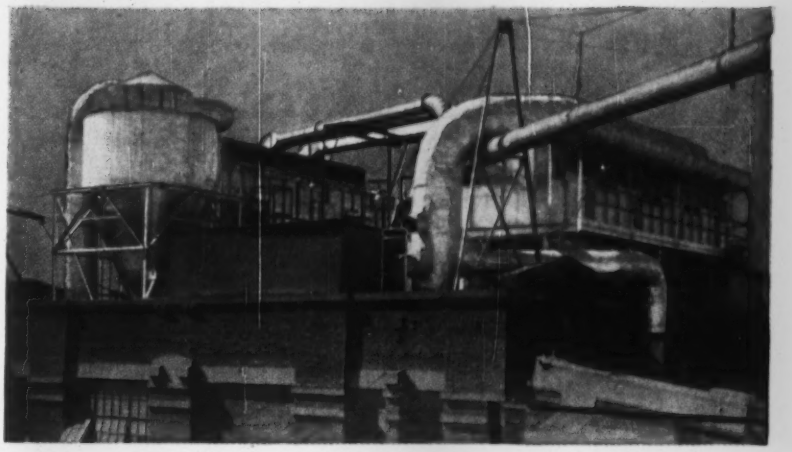
The unit is said to be easily installed over doorways, in closets, or other out-of-the way places, and is suited for use in schools, office buildings, industrial plants, laboratories, churches, gymnasiums.

One and two-fan models are available, with two-fan units mounted side-by-side on a single shaft to maintain a flat, compact cabinet. Bearings, drives, and motor are mounted outside the cabinet.

Air inlets to the fan housing provide an unbroken path for smooth air flow to the fan wheel, which is designed to cut the air stream cleanly, without turbulence and at a minimum noise level. In addition, fan shafts are sized large to add an extra assurance of quiet, vibrationless performance.

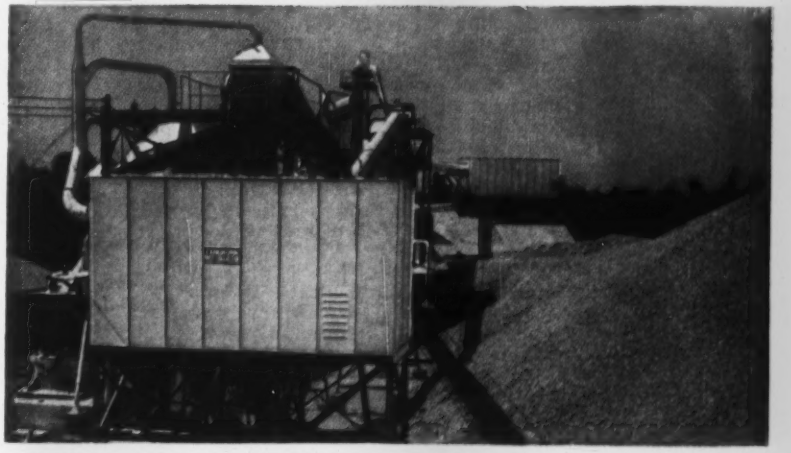
Low-speed, centrifugal fan wheels provide high capacity air delivery, required in high pressure systems. Fan characteristics are

GRAIN...



KELLOGG COMPANY, Battle Creek, Mich., saves $1,400 a *day* with Pangborn Dust Control! That's the value of the 35 tons of cereal "dust" salvaged every 24-hour day. In addition, Pangborn Cloth Screen Collectors keep Kellogg's buildings spotless, reduce machinery maintenance and have made working conditions safe and comfortable for employees.

or GRANITE...



H. E. FLETCHER CO., West Chelmsford, Mass., produces a wide variety of granite products. When Fletcher recently expanded plant operations, the firm installed Pangborn Cloth Screen Dust Collectors on the recommendation of an already-satisfied user of Pangborn Dust Control. Today costs at Fletcher have been cut in three ways; salvaged dust is sold to another firm, machine life is lengthened by reducing dust damage, plant housekeeping is cheaper.

Pangborn CONTROLS DUST

Pangborn can solve *your* dust problem. Pangborn engineers will be glad to show you how Pangborn Dry or Wet Dust Collectors can save you time, trouble and money! See how Pangborn benefits varied industries. Write for free copy of "Out of the Realm of Dust." PANGBORN CORP., 2200 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control and Blast Cleaning Equipment.*

Can you qualify for one of these six specialized engineering positions?

1 **Experienced Instrument Engineer.** Design work on aircraft instruments, controls and displays. Electrical Engineering degree or equivalent essential. Human Factors engineering experience on displays desired.

2 **Experienced Human Factors Engineer.** Design work on aircraft control and displays. Industrial Psychology degree or equivalent essential. Specific experience on instruments desired.

3 **Experienced Aircraft Air Conditioning Engineer.** Work on weapons system advanced design aircraft. BSME or equivalent essential.

4 **Experienced Aircraft Engineer.** Work on environment control engineering or weapons system advanced design aircraft. BSME or equivalent essential.

5 **Experienced Aircraft Engineer.** Work on escape systems design on weapons system advanced design aircraft. BSME or BSAE degree or equivalent essential.

6 **Experienced Aircraft Engineer.** Cockpit arrangement and provision studies on weapons system advanced design aircraft. BSME or equivalent essential. Human Factors experience desirable.

CONTACT: Mr. Les Stevenson, Engineering Personnel, Dept. 56-ME, North American Aviation, Inc., Los Angeles 45, California.

LOS ANGELES DIVISION

NORTH AMERICAN AVIATION, INC.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

KEEP INFORMED — NEW EQUIPMENT BUSINESS NOTES LATEST CATALOGS

such that the point of highest efficiency is very nearly identical to the point of highest pressure. This allows the fan to deliver air against considerable resistance, at minimum power supply, the company states.

Optional equipment for the cabinet fan includes filters, mixing box, and dampers. Filters are permanent or throwaway type mounted in sturdy frames, and bolt easily to the fan cabinet. Bolt-on mixing boxes may be attached to temper cold outside air with warmer, recirculated interior air.

Gear Pump

A gear pump, said to feature simplicity of design that lends itself to low cost manufacturing techniques has been developed by New Products Corp., 3636 Oakton St., Skokie, Ill.

Suitable for fluid pressure up to 200 psi, the new pump can be adapted for a multiplicity of applications, including engine oil pumps, primary pumps for fuel injection systems, pumps for automatic transmissions, pumps for oil burners, pumps for low pressure machine tool mechanism, pumps for manufacturing equipment, the firm states.

The typical arrangement for a basic version of the pump shows the two conventional gears mounted on shafts in a simple housing which can be designed to suit the specific application. According to the company, unique feature of the design which sets it apart from the conventional is found in the fact that the mating gears can be mass produced without the penalty of close tolerances or fine tooth finish. They can be hobbed or rolled or made of metal powder.

Similarly the housing cavity can be used practically as die-cast without machining or profiling around the periphery due to the fact that peripheral clearance plays no part in the performance of the pump, the firm states.

Secret of the performance of the pump stems from three basic elements that constitute the heart of the invention, the company says. First is a molded synthetic rubber element which conforms with zero clearance to the gear teeth along the pressure outlet side of the pump. This is the only area that requires close clearance and at this point it is feasible to achieve zero clearance without resorting to fine mechanical tolerances.

A calibrated spring is installed to control the action of the tip clearance pad. In effect, it serves as a pressure relief valve, so calibrated as to cut off at an established maximum pressure value, thereby permitting the tip clearance pad to retract from its contact with the gears.

The third feature is a molded synthetic rubber diaphragm installed under the two gears. Its use permits a reasonable degree of back-lash in the mounting of gears within the housing, again contributing to low cost machining practice. In operation, the diaphragm is automatically inflated by pressure fluid, thereby taking up all clearance between the upper and lower faces of the gears.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Rotary Compressor

A new 5 hp tank-mounted rotary compressor for general industrial applications is announced by Davey Compressor Co., Kent, Ohio.

Called the Hydrovane, the unit has a displacement of 21 cfm. It is direct connected to an 1800 rpm 5 hp electric motor and is available with modulation, start-stop, or combination modulation-stop-start control as desired.

Maximum working pressure is 200 psi for continuous operation. For intermittent use, compressors may be operated at 250 psi. Units are available with either horizontal or vertical air receivers (tanks).

According to the company the outstanding design feature of the unit is its patented "multi-thrust" rotor blade and contour-bored stator. This rotor-stator arrangement, in combination with two multi-stage cooling oil injection chambers, is said to compress air more efficiently, quieter, with less vibration, and at a lower temperature than is possible in other two-stage designs. The manufacturer claims that Hydrovanes possess fewer working parts than other compressors of either rotary or reciprocating types. Pistons, rings, rods, valves are eliminated by the design.

Over-all dimensions of the unit with horizontal tank, are width, 25 in.; length, 48 in.; height, 44 3/8 in. The vertical tank unit is 25 in. wide, 35 1/4 in. long and 72 1/2 in. high. Weight of both compressors is 400 lb.

Diaphragm Gas Valves

Addition of two new models to its line of relay-operated diaphragm gas valves has been announced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

The two new valves will become the firm's basic line-voltage models for commercial and industrial burners of 5 lb rating. One valve model, V-48F, is furnished with position indicator but without manual opener and is designed for final shut-off service. The other model, V-48G, is a general-purpose type and is available with manual opener but without position indicator.

Both types are available in 2-, 2 1/2-, and 3-in. sizes and can be used with all gases including LP and high-sulphur-content gas, the firm states.

According to the company, the new models make available a complete line of low-pressure and high-pressure types for large domestic, commercial and industrial applications in both 8-oz and 5-lb models.

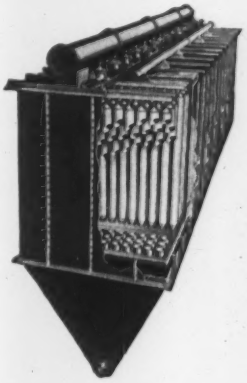
All the models feature compact design, quiet operation, large valve actuator porting and increased capacity, the company says. They are designed for right-or left-hand installation and use a weight- and spring-loaded diaphragm for dependable closing. Electrical parts are mounted outside the gas stream and terminals are provided for each electrical connection.

Norblo solves dust problems

Whatever you need in dust or fume control, be sure to check *Norblo*

In Bag Type, Centrifugal or Hydraulic dust collecting systems, Norblo Dust and Fume collection equipment has many design advantages. These three types, frequently used in certain combinations, provide economical dependable control as required in smelting, rock products, chemical, milling and processing fields.

What is the best approach to your dust problems? Norblo helps you select—applies engineering skill and "know how" gained in first hand experience of over 40 years in many industries.



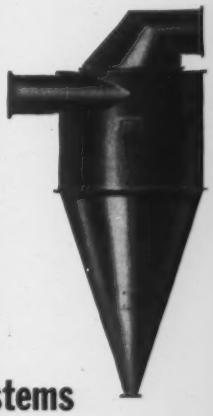
Norblo Bag Type Systems

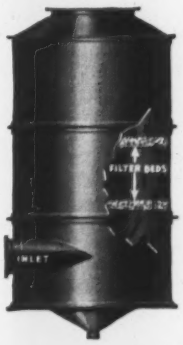
Automatic and Standard

For continuous or heavy duty service providing very high efficiency at very low cost of operation and maintenance. Basic unit contains 78 bags, 6" diameter, 8' 3" long. Air flow is upward, from inside, thus keeping bags fully distended. Total free cloth area per compartment 936 square feet. Shaking and cleaning controlled by electric timer, is cyclic, one compartment at a time, each having its individual compressed air shaker mechanism and the whole system variable and adjustable for dust load without shutting down . . . Also Norblo Standard Bag Type (non-automatic).

Norblo H. E. L. S. Centrifugal Systems

A cyclone or centrifugal type collector for all materials, from sawdust to fly ash; characterized by high efficiency of collection with low static drop. The Norblo H. E. L. S. has no internal vanes, gadgets or dampers. High efficiency is obtained by scientific proportioning and by the patented (No. 2,259,919) expanding nozzle. These design features eliminate the power-wasting back eddy. Built in standard sizes with capacity up to 37,500 cfm.





Norblo Hydraulic Systems

A high efficiency, wet type collector, for separation of dust mixed with smoke or fumes. In most installations the Hydraulic unit is used with a Norblo Cyclone collector, thus reducing the amount of wet sludge to be handled. No moving parts. Filter beds are coke or high-fired ceramic tubes, light weight and kept in motion by ascending air stream. Beds are self-cleaning. Built in standard sizes with capacities up to 26,000 cfm.

Take advantage of the efficiency and low maintenance available through Norblo Equipment in these three proved systems of dust and fume collection. Write for full information.

The Northern Blower Company
6421 Barberton Ave., Cleveland 2, Ohio • OLympic 1-1300

Norblo ENGINEERED DUST COLLECTION SYSTEMS FOR ALL INDUSTRIES

BINDERS

For Your Codes and Standards

These Binders are well constructed, open flat; hold the publications firmly; and permit insertion, removal and transposition of contents easily. They are made of durable cloth, have identifying title stamped on the spine, and are 9" x 12" in size.

The Binder for the ASME Boiler and Pressure Vessel Code has a four inch capacity and is equipped with twelve flexible steel rods. That for Standards and Codes has a three inch capacity and holds from twenty to twenty-five pamphlets.

$3.25 Each

20% discount to ASME members.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
29 W. 39th St., New York 18, N. Y.

PAST EXAMINATIONS
for Professional Engineers given by New York State

This pamphlet contains the questions given in 1952–1956 examinations. They cover problems in structural planning and design, in practical applications of basic engineering sciences, and the more advanced and specialized problems in practical applications of engineering principles and methods.

$2.00 (20% Discount to ASME members)

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
29 W. 39th St., New York 18, N. Y.

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Temperature Regulator

A new safety-type temperature regulator has been added to the line of self-powered control instruments manufactured by Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville, Tenn.

Designated the No. 997 temperature regulator, it will close automatically to prevent overheating and possible damage to products in process, in the event the thermostatic unit is accidentally damaged, the firm states.

The unit contains a $4^{5}/_{8}$-in. bellows for more powerful response and smoother modulating action in controlling the flow of steam, hot water or other medium. Because it has a special tight-closing, single-seated valve, it is suitable for dead end or terminal service the company says. It is available in sizes from $^{1}/_{4}$ to 2 in. Another feature of the new regulator is a heavy gage stainless steel frame.

The manufacturer recommends the unit for temperature control of industrial processes, storage or instantaneous water heaters. Equipped with reverse-acting valves, the regulators are suitable for the flow control of cooling water to transformers, internal combustion engines, air compressors and degreasers.

Coil Winding

Electro Devices, Inc., 580 Main St., Wilmington, Mass., announces the availability of another in its line of toroid coil winding equipment. This addition, Model C, is especially designed for the precision winding of prototype quantities of toroil coils.

The new laboratory model is said to be relatively low in cost and to permit greater flexibility in coil design without the delay normally experienced when coils are wound outside the plant. For increased versatility, Model C can also be used for the precision manufacture of small production quantities, the firm states. Its accurately controlled motor-driven winding arrangement permits winding speeds up to 150 turns per min.

The unit incorporates the patented method of winding off the inside of the shuttle. This permits winding finished coils having an inside diameter as small as $^{3}/_{32}$ in. Maximum finished coil diameter is 1 in. Model C is designed to eliminate wire strains and winds sizes from 30 to 46 gage. It provides full 360-deg coverage of the core. Segment winding is said to be easily accomplished on this machine. Special arrangement of brushes keeps tension on the loop and confines the wire to a simple plane between the shuttle and the core. Wire flows out straight through a hardened and highly polished vent in the shuttle.

According to the company, these features eliminate troublesome wire kinks, twists, and abrasions when pulling out. This machine can wind multiple strands of wire at the same time—up to five strands of No. 36 wire simultaneously on the core.

Did you know that

The Engineering Societies Library

can serve you by air mail and air parcel post? Over 170,000 engineering texts, and files of every worthwhile periodical are available for further research to meet your specific needs—patents, design, research, construction, and management problems. Charges cover only the cost of the services and represent but a fraction of the value you will receive.

The Engineering Societies Library
29 West 39th Street, New York 18, N. Y.
Mr. Ralph H. Phelps, Director

Please send me information pamphlet on services available, how air mail can expedite them, and their cost.

Name .....

Street .....

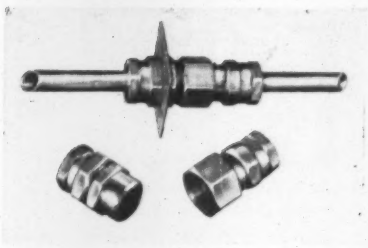
City .....

State .....

ME-1

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS



Freon Coupling

The development of a new self-sealing coupling for applications of freon 12 and 22 has been announced by Aeroquip Corp., Jackson, Mich.

The new coupling, Series 5400, is designed for all types of freon applications, and is said to be particularly suited where there is a necessity for precharging air conditioning units with freon at the factory. According to the company, manufacturers can use the coupling to fill and charge units with freon for shipment to distributors with no loss of freon during transit or extended periods of storage in distributors' warehouses. At the time of installation, no further bleeding or charging of the lines is necessary, the firm states.

The coupling is designed for easy bulkhead installation. A jam nut locks one section of the coupling to a bulkhead. The adapters of the coupling are recessed for brazing to copper tubing. The coupling will be available in $^1/_4$ through $1^1/_2$ in. OD tube sizes.

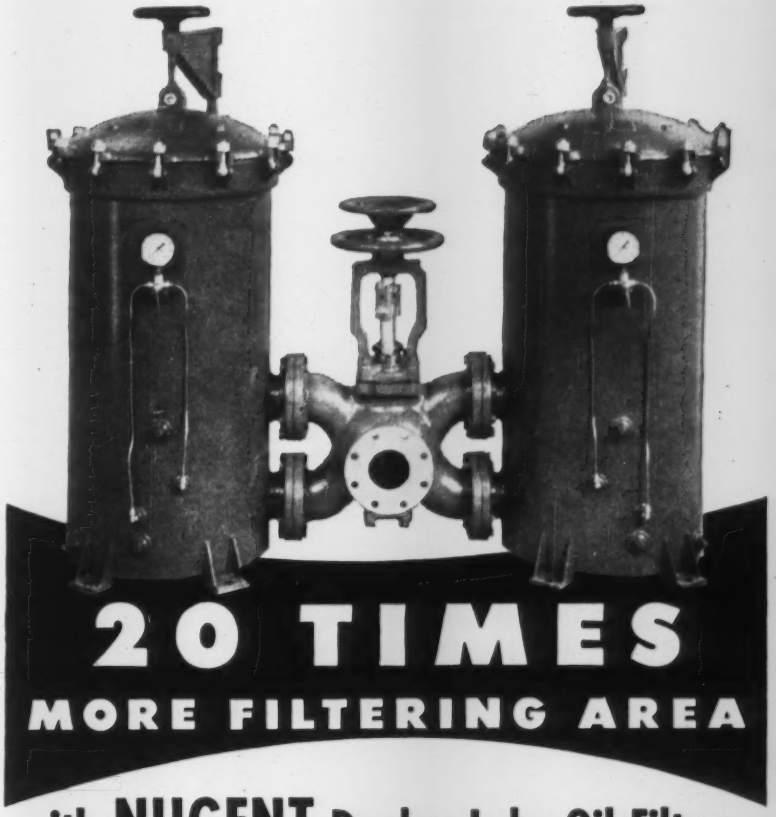
A-C/D-C Electrode

Two of the Firm's most widely used low temperature welding alloys, EutecTrode 68 AC and 680 DC, have been combined in an a-c/d-c electrode for high alloy steels, it is announced by Eutectic Welding Alloys Corp., Flushing, 58, N.Y.

The new electrode is available in $^3/_{32}$, $^1/_8$, $^4/_{32}$, and $^3/_{16}$ in. diam. It produces joints with an ultimate tensile stength up to 120,000 psi and deposits take a high polish, the company states.

According to the firm, the convenience of a-c/d-c operation with one electrode makes it an ideal replacement for conventional electrodes used on dissimilar alloy steels, highest tensile work where embrittlement must be avoided, and for carbon, spring, tool, and die steels.

The new electrode is said to deposit a structure with smaller grain size than that from conventional electrodes. It produces an austenitic matrix with ideal ferrite balance which results in ultimate crack resistivity in any type of stressed joint. The specially balanced alloy formulation maintains ferrite formers such as chromium, silicon and molybdenum in an exact ratio relative to austenite formers such as carbon, manganese and nitrogen, the company states.



20 TIMES
MORE FILTERING AREA
with NUGENT Duplex Lube Oil Filters

This new large capacity duplex full flow lube oil filter consists of two parallel filters with a flanged switching valve supported between them. Each filter is equipped with a three-way cock and differential pressure gauge and has a capacity of 225 GPM of 150 SSU viscosity lubricating oil at about 5 psi. pressure drop. They may be operated independently or in parallel.

Nugent filters provide 20 times more filtering area than most other filters of comparable size. "Extended area" filtering is yours because Nugent utilizes a laminated crenulated fiber disc filter cartridge affording filtering action both through proximate discs and adjacent portions for maximum filtering capacity. The duplex has a high flow rate at low pressure drop combined with extremely fine filtering absorption and neutralizing properties of a depth type filter.

A lifting mechanism facilitates cover removal and exchange of filter recharges which have a useful life 4 to 10 times that of other types and are expendable.

If you must filter fuel, lube oil or coolants, there is a Nugent filter to meet your requirements. Write for descriptive literature.

Wm. W. Nugent & Co., Inc.
3412 Cleveland St. Skokie, Illinois

Established 1897

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

NEW EQUIPMENT and NEW METHODS

13th INTERNATIONAL HEATING & AIR-CONDITIONING EXPOSITION

(formerly the International Heating & Ventilating Exposition)

INTERNATIONAL AMPHITHEATRE
CHICAGO

FEB. 25 to MARCH 1, 1957

Under the auspices of the American Society of Heating and Air-Conditioning Engineers, and in conjunction with their 63rd annual meeting.

IN the largest exposition of its type in the world, there will be new equipment, new methods, new technical information. More than 450 companies will welcome you, your key men and associates in Chicago next February. Make it your *first* New Year's Resolution to write for advance registrations to:

13th INTERNATIONAL HEATING & AIR-CONDITIONING EXPOSITION

480 Lexington Ave., New York 17, N. Y.

Management: International Exposition Co.

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Dynamic Shock Tester

A new dynamic shock testing instrument, the Hyge Actuator, is now available from the Rochester Div., Consolidated Electrodynamics Corp., 1775 Mt. Read Blvd., Rochester 3, N. Y.

The instrument accurately simulates shock experienced by equipment in actual use, the firm states.

No larger than a golf bag, the actuator is said to be capable of producing extremely high loads instantaneously and exactly, with precision waveform control. A single actuator 26 in. high and 3 in. in diam is capable of a 12,000-lb thrust. According to the company, where present shock testing devices can apply but limited ranges of accelerating and decelerating forces, this hydraulic instrument can apply widely varying forces for controlled periods of time. The actuator is also claimed to meet secondary requirements of versatility, repeatability, economy of operation, reliability, and high testing rates.

The device is essentially a piston in a cylinder, subjected to differential pressures on its two faces, and requires no complicated controls or elements. It has two moving parts—the piston and a floating seal.

Built of modular components, the actuator is available in a variety of forms to meet any application, and is easily adapted to new problems, the company says. For testing of very large objects, a group of the instruments can be connected and fired simultaneously to provide additional power and range.

According to the manufacturer, some of the most important applications of the new device will be in the shock testing of components of turbines, aircraft, missiles, rockets, and other ordnance equipment. Brochure No. 20-1 describing the unit is available from the company.

Temperature Controllers

Fenwal Inc., Ashland, Mass., announces two new dual-range models in its Series 560 line of thermistor-actuated temperature controllers. According to the company, the development of these dual-range models extends the operating range of thermistor controllers and for the first time permits their use for sub-zero applications.

The operating ranges of Model 56006 are 200–600 F and 100–300 F, providing a total coverage of 100 to 600 F. Model 56007 will cover −100 to +50 F and 0 to 150 F, providing a total spread of −100 to +150. The ranges can be switched instantly without recalibration or other adjustments by positioning a selector switch on the front panel, the firm states.

Because thermistors undergo a large change in resistance per degree of temperature change, these controllers deliver exceptionally accurate control (.25 per cent over their entire control range), the company explains. Connecting leads can be up to 200 ft long,

ENGINEERS
Mechanical & Electromechanical

APL-An Organization Of And For Technical Men And Scientists

The Applied Physics Laboratory, (APL) of the Johns Hopkins University is an organization of and for technical men and scientists. APL is organized on a horizontal *basis*; responsibility and authority are given in equal measure. Scientists and technical men occupy all decision-making positions, because our *only* objective is technical progress.

Because of its predominantly professional character, APL has kept in the vanguard, having pioneered the proximity fuze, the first supersonic ramjet engine, the Navy's Bumblebee family of missiles which includes the TERRIER, TALOS and TARTAR; and is presently attempting break-throughs on several important fronts.

Occupying a site equidistant from Washington, D. C., and Baltimore, Maryland, APL's new laboratories allow staff members to select urban, suburban or rural living, and either of these outstanding centers of culture as a focal point for fine living. Salaries compare favorably with those of other R & D organizations.

OPENINGS EXIST IN:

DESIGN: Airframes and structures; hydraulic and power supply systems; servomechanisms; launching and handling equipment; ramjet engines.

ANALYSIS: Stress; weights and loads; heat transfer; dynamics; warheads.

Write for complete information. Your letter will be answered personally, in detail. Address:

Professional Staff Appointments

The Johns Hopkins University Applied Physics Laboratory

8607 Georgia Avenue, Silver Spring, Md.

DESIGNERS

WHAT major organization offers continual original work assignments?

For the answer turn to page 155

CANCER LIFE-LINE

Through films, pamphlets, posters, exhibits and lectures, our life-line of cancer education reaches men and women in business and industry.

They learn facts about cancer which could mean the difference between life and death. For additional information about a program in your plant call the American Cancer Society or write "Cancer" care of your local Post Office.

AMERICAN CANCER SOCIETY

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

using ordinary electrical wiring without diminishing sensitivity and control accuracy. The company says the instrument is ruggedly built, is not position sensitive, and can be moved from one location to another without affecting accuracy or calibration. Because of the high stability and excellent aging characteristics of the thermistor sensing element, the controller can be operated for periods of several months or more without recalibration. When it is necessary, recalibration is done with screwdriver adjustments without external reference standards.

The thermistor controllers offer a choice of two control modes: on-off (two position) control and time-modulated proportioning. The controllers contain an integral SPDT power relay rated at 10 amp, 115 VAC. Separate circuits for indication and control make these two functions independent; hence an indicating potentiometer, more rugged than the type conventionally used, can be employed without affecting control accuracy, the firm says.

The thermistor sensing element can be supplied encased in a stainless steel probe $^{3}/_{16}$ or $^{1}/_{8}$ in. in diam and 2–5 in. long, with a choice of three types of mounting heads. However, when installation space is critical, a bare thermistor probe, little bigger than a common pin, can be obtained.

Optical Comparator

An optical comparator said to lower inspection costs by permitting rapid examination of tolerance limits of small precision parts by projecting the magnified image of their outline or surface texture on a large ground glass viewing screen, is announced by Nikon, Inc., 251 Fourth Ave., New York 10, N. Y.

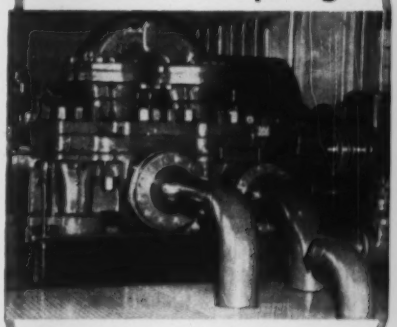
According to the company, a feature of the comparator is a Nikkor lens system which makes possible an extremely bright, undistorted and evenly illuminated viewing image. The comparator and lenses are the products of Nippon Kogaku K.K., Tokyo.

Different magnifications can be quickly obtained through the use of any one of four lenses which are mounted in a revolving turret, permitting a rapid interchange to selected magnifications, the firm states. Telecentric turret mounting condensers provide maximum illumination efficiency at each magnification. The parfocal lenses have magnification powers of 10x, 20x, $31^{1}/_{4}$x, 50x, $62^{1}/_{2}$x, and 100x and are specifically built for precise image resolution, even in the periphery of the image field.

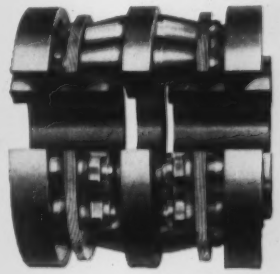
With these lenses, the company says, objects can be measured with extreme accuracy by projecting their image on the ground glass screen over which has been placed a translucent sheet on which a precise, enlarged-to-scale contour pattern has been traced. Layover clips on the ground glass screen hold the sheet firmly in place.

The object to be examined may be illuminated from below or above from a vertical or oblique position. Illuminated from be-

PROTECT YOUR PUMPS with THOMAS Flexible Couplings



One Chemical Engineer reports he formerly spent 95% of his time supervising repacking of pump glands. Then he installed Thomas Flexible Couplings. Now his pumps need no attention.



Only THOMAS Flexible Couplings offer:

UNDER LOAD and MISALIGNMENT

1. No Cross-pull on Bearings or Gland.
2. No End-thrust on Bearings or Impeller.
3. Freedom from Backlash—Torsional Rigidity
4. Free End Float
5. Smooth Continuous Drive with Constant Rotational Velocity
6. Visual Inspection in Operation
7. Original Balance for Life—*and*

THOMAS ALL-METAL COUPLINGS HAVE NO WEARING PARTS SO THEY REQUIRE NO LUBRICATION AND NO MAINTENANCE

Write for Catalog 51A

THOMAS FLEXIBLE COUPLING CO.

WARREN, PENNSYLVANIA, U.S.A.

It's Not The TOOT That Runs The Train

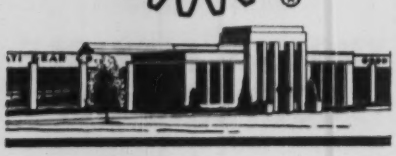
Frank Sorenson, Jr.

TREASURER, THE CINCINNATI GEAR CO.

Did you ever get a tune lodged in the back of your head, and not be able to get it out? I happened to hear a catchy children's record awhile ago that keeps popping up in my mind; I'm a little fuzzy on the exact details but the gist of the lyrics is that "it's not the toot that runs the train, but the chug chug chug." Even though the song was obviously written to appeal to young children, the simple logic of its message is just as important to us grown-ups. Because it is all too easy to lose track of basic objectives in the normal rush of competitive business and the manufacture of a competitive product. To cut a nickel here or there off the "toot" to meet competition is one thing; but if a dime or two also gets cut off the "chug chug chug" for the same reason, it may *show up* for the first time when the product is in the consumer's hands — with lasting adverse effects. Any such quality lapse in the important O.E. products into which many of our custom gears go would be a serious matter for the manufacturer. Our clients know this, and they know that a gear can be a crucial part in their product — and that's why they come to us. They have found from experience that we make their custom gear costs *inexpensive* by giving them the *quality* and *service* they require. We'll do the same for your firm, if given the opportunity.

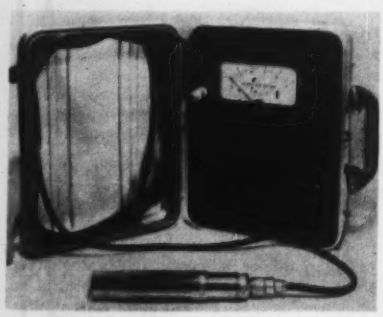
THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
Fifty Years of "Gears—Good Gears Only"

CINTI



KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

low, the outline of the object is projected on the screen. When illuminated from above, the surface topography of the object can be examined for texture, finish, corrosion, wear.



Radiation Monitor

An all-purpose laboratory radiation detection monitor, said to be ideal for use in detecting Alpha, Beta (including Carbon 14 and Sulphur 35), and Gamma radiation dosage, leakage, accidental spillage, and contamination has been developed by Universal Atomics Corp., 143 E. 49th St., New York 17, N. Y.

This lightweight unit can operate 24 hr a day, and can be preset to sound a loud warning alarm and flash a light at a predetermined level of radioactivity, the firm states. It operates from either 110 v-a-c current, or as a portable unit from batteries; reads up to 50,000 cpm; and weighs 6 lb. It is provided with 25 ft of cable. Additional cable is available.

The instrument is available in a sloping front console (420A), and in a lightweight, watertight aluminum suitcase (420B)

Screw Machine Tap

A new stub tap designed and manufactured specifically for use in screw machines has been announced by Pratt & Whitney Co., Inc., West Hartford, Conn. Shorter in length, this new cutting tool incorporates features which are said to eliminate most of the tapping difficulties encountered when using conventional taps in screw machine operations.

Features of the new tap include a necked shank for generous lubrication; a spiral point to reduce torque and improve chip disposal; and a short thread length to counteract the tendency to produce bellmouth threaded holes because of misalignment. Stub taps of this new design have been tested in the field over a three-year period, and excellent performance is reported by the company.

The taps are available from stock in high speed steel ground thread, NC or NF, plug or bottoming chamfer, in Nos. 2 to 10 machine screw sizes, to GH2 limits.

Continued on Page 74

WE DON'T WANT JUST ANY MECHANICAL ENGINEER BUT—

IF you are an M.E. or advanced graduate, well experienced in the design and development of intricate mechanisms—small gear, cam, lever devices and have a natural flair for these . . .

IF you know the processes by which such designs are put into quality, quantity production . . .

IF you are adept at getting your ideas across to others, and one of you is capable of supervising the work of other engineers . . .

THEN YOU'VE GOT A BRIGHT FUTURE AHEAD OF YOU AT DELCO RADIO

. . . because Delco Radio offers you—

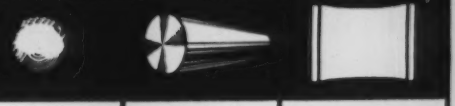
- A big-city salary and small-town advantages.
- Excellent opportunities for advancement.
- Modern work facilities.
- All the unusual employee benefits of General Motors.
- AND a wonderful community to live in, right in the heart of homey Indiana.

WRITE TO:

Personnel Director—B
Delco Radio,
Division of General Motors
Kokomo, Indiana

for heavy-duty shock load service...

which bearing is best?



	Ball	Tapered Roller	Shafer
Low Friction Loss	✓		✓
Self-Alignment	✓		✓
High Radial Load Capacity		✓	✓
High Thrust Load Capacity		✓	✓
High Shock Load Reserve		✓	✓
Long Life		✓	✓
Fast, Positive Adjustment			✓
Lowest First Cost	✓		
Lowest Over-All Cost			✓

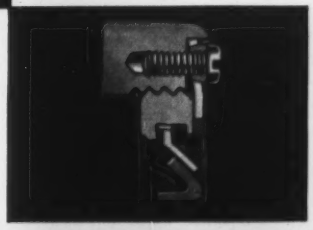
SHAFER Self-Aligning Roller Bearings give you more

Inner race is segment of a ball.

Roller presents matched curve surface.

Shafer design combines both the low rolling friction of a ball and the high load carrying capacity of a roller. Under shock loads, continuous heavy-duty loads—even under conditions of misalignment—Shafer Bearings maintain full load capacity. You can get off-the-shelf delivery of standard pillow blocks, flange units, flange cartridge units and take-up and frame units. Call your nearby CHAIN Belt District Office Representative or Distributor.

and...



"Z" seal keeps dirt out ...grease in

Shafer exclusive—"Z" seal is an all-metal, non-rotating, true self-aligning seal that provides positive sealing under severe conditions.

Micro-lock wear adjustment

Shafer exclusive Micro-Lock provides 12-point adjustment compensating for wear or unusual operating conditions.

Get full information on high bearing capacity. Write for catalog 55A.

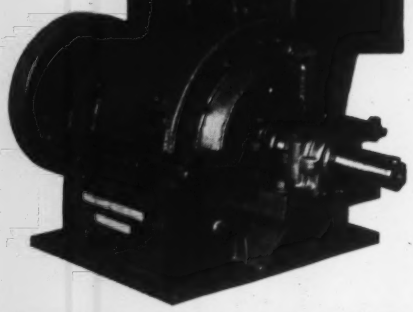
CHAIN BELT COMPANY

4768 W. Greenfield Ave., Milwaukee 1, Wis.

PRECISE REDUCTION
for { EXPERIMENTAL LABS
PILOT PLANTS
TEST RUNS

American
No. 13 Series
CRUSHERS

Designed for capacities beyond those of lab mills and below those required for large-scale crushing operations. Effectively used for wide range of materials. Up-Running Models (for maximum fines); Down-Running (for minimum fines). Equipped with rings or any of a full variety of hammers. Backed by over 40 years' experience in building reduction equipment. Write for Catalog on "13" Series Crushers.

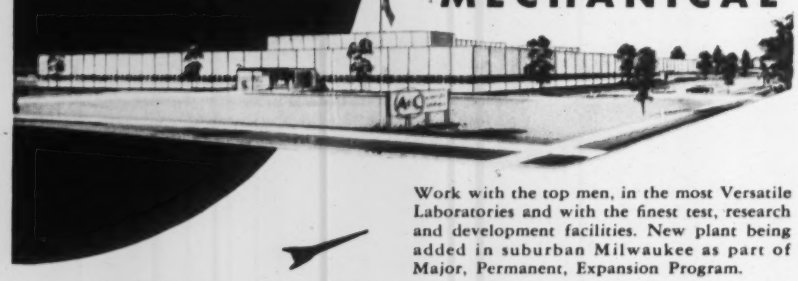


FREE Laboratory Service

Send material sample for test reduction and recommendations for reduction equipment.
No obligation.

American PULVERIZER COMPANY
Originators and Manufacturers of Ring Crushers and Pulverizers
1541 MACKLIND AVE. • ST. LOUIS 10, MO.

ENGINEERS
DESIGN MECHANICAL



INERTIAL GUIDANCE SYSTEM PROGRAM

- Vibration and Stress Analysis
- Mechanical Design
- Electronics Package Design
- Electronics Package Cooling

Work with the top men, in the most Versatile Laboratories and with the finest test, research and development facilities. New plant being added in suburban Milwaukee as part of Major, Permanent, Expansion Program.

AC provides financial assistance toward your Master's Degree. Graduate Program also available evenings University of Wisconsin, Milwaukee.

GM's aggressive position in the field of manufacture and GM's policy of decentralization creates individual opportunity and recognition for each Engineer hired.

Milwaukee offers ideal family living in a progressive neighborly community in Southern Wisconsin.

For personal confidential interview in your locale send full facts about self to

Mr. John F. Heffinger,
Supervisor of Technical Employment

Recent EE, ME Graduate Inquiries Also Invited

THE ELECTRONICS DIVISION
GENERAL MOTORS CORP.
Flint 2, Mich. Milwaukee 2, Wis.

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Heating, Ventilating Unit

A new, large capacity "Torrivent" heating and ventilating unit featuring sectionalized design has been announced by Trane Co., La Crosse, Wis.

Nine unit combinations are offered in the line, ranging from a basic model supplying untempered make-up air to a deluxe model that provides heating, ventilation and humidification. The deluxe model includes an insulated and baffled discharge plenum with insulated enclosure for motor mounting, fan section and coil with attached face and bypass section, and a combination filter-mixing box. Outside air is brought into the deluxe model through a wall intake box featuring chevron rain baffles and a protective screen.

The unit is especially designed for use in large buildings which require ventilation with heating, such as auditoriums, theatres, garages and industrial plants.

According to the company wide coil selections provide a range of final temperatures that make the unit ideal for both comfort and process applications. Typical process work uses include curing-drying, fog removal, exhaust of contaminated air, and moisture control.

Engineered to deliver large air volumes quietly and economically, it has an exclusive louver fin discharge grille completely adjustable for air discharge patterns. Capacities range from 1150 to 36,000 cfm of air delivery and from 50,000 to 1,900,000 Btu.

Other features include a specially designed Model 3U fan for operation at extremely low noise level; compact casing and removable panels for easy access to components.

Coils can be one to three rows as desired. There are three fin spacings in a choice of three coil types. Filters are throwaway or permanent type, either of which are available for low, intermediate, or high air velocities.

Cast-Iron Brake Motors

Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio, has introduced a new line of rugged, cast-iron brake-motors said to stop instantly and hold heavy loads. The company claims that advanced design and totally-protected components are combined to assure long life and trouble-free operation on all types of equipment from bottle-washing machinery to heavy-duty cranes.

Features include a wide torque range from 3 lb-ft to 345 lb-ft, one-piece molded friction linings for quick stops, and one-operation torque setting. In the event of power failure or low voltage, "dead man" operation sets and holds the load until normal operation is restored. The firm says the design incorporates a minimum of wearing parts, and any adjustments may be performed with ordinary tools by removing the brake housing and lifting out the entire operating mechanism.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

All types of enclosures are available including those suitable for outdoor installation or where extremely moist, corrosive, or abrasive dust conditions exist. Standard enclosures include protected, totally-enclosed nonventilated, totally-enclosed fan-cooled, and explosion-proof Class I, Group D and Class II, Groups E, F, and G.

BUSINESS NOTES

Address Change

Southwest Products Co.'s new address is 1705 So. Mountain Ave., Monrovia, California. No move was made; rather, the city of Monrovia is annexing that part of Duarte in which their factory is located. The change is effective January 1, 1957. Telephone numbers remain the same.

Seven New Representatives

A. W. Cash Co., and its subsidiary Cash Standard Stacon Corp., both of Decatur, Ill., have announced the appointment of seven new representatives for pressure, temperature, hydraulic, process, and combustion control equipment. The new representatives are as follows:

In the San Francisco and northern California area: E. C. Cooley Co., 1186 Folsom St., San Francisco 3, Calif; in the southeast Texas area; Gay Sales Company Assoc., 420 Sul Ross St., Box 13232, Houston, Tex.; in the Montreal area; Lytle Engineering Specialties Ltd., 360 Notre Dame St., W., Montreal 1, Quebec.

In the east Tennessee and southwest Kentucky area; McGinnis-Hill Co., 4809 Clinton Highway, Knoxville, Tenn.; in the Ontario area: Noel Moffitt Co., Ltd., 203 Church St., Toronto, Ontario; in the Utah; north and east Nevada area; North-Monsen Co., Box 174, Salt Lake City 10, Utah.; in the southern California and southwest Nevada area; Richard S. Dawson Co., 333 Glendale Blvd., Los Angeles 26, Calif.

Properties of Steam at High Pressures

This is an interim steam table covering a range from 5500 to 10,000 psi and 32 to 1600 degrees F. It is published to provide a reasonable extrapolation of the current tables that will be useful in power systems calculations until an authoritative steam table has been published—five years hence.

1956 $1.00 20% Discount to ASME members

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
29 W. 39th St., New York 18, N. Y.

GOULDS PUMPS, INC., Seneca Falls, New York

Check bulletins you'd like to receive:

☐ Pump Fundamentals. A brief outline of the characteristics, operation and criteria for selecting reciprocating, rotary, and centrifugal pumps.

☐ 710.1 "Close-cupld" Centrifugal Pumps.
☐ 721.6 Single-stage Double-suction Pumps.
☐ 725.4 Centrifugal Chemical Pumps.
☐ 726.1 Vertical Centrifugal Pumps.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

How to buy a better pump

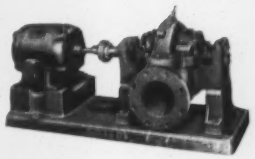
When you have to choose from dozens of pumps of different types and brands, it's hard to tell which will work best for you at the least cost.

However, when you know what to look for and how to look, you can match a pump to your needs almost exactly.

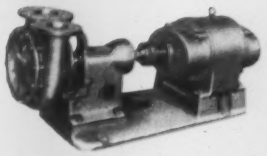
Just five of hundreds of bulletins we've prepared to help you buy wisely and well are offered above. Send for them and use them when you need a general purpose pump.

When you have a particular application in mind, write us the essentials. We'll be glad to advise you on the pump or pumps that will work best for your purpose.

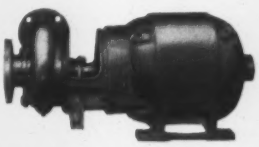
4 general purpose pumps



1. For large capacity pumping, the Goulds Fig. 3405. 33 sizes with capacities up to 6400 GPM; heads to 425 ft. Send for Bulletin 721.6.

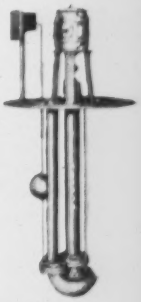


2. For economical handling of hot, corrosive or abrasive liquids, the Goulds Fig. 3715 stainless steel pump. 9 sizes with capacities up to 720 GPM; heads to 200 ft. Send for Bulletin 725.4.



3. For use where space is at a premium, the Goulds Fig. 3655 "close-cupld" pump. 20 sizes with capacities up to 2000 GPM; heads to 400 ft. Send for Bulletin 710.1.

4. A submerged-type sump pump for depths of 3 to 20 ft., the Goulds Fig. 3047. 4 sizes with capacities from 10 to 650 GPM; heads up to 65 ft. Send for Bulletin 726.1.



MEMBER

Goulds PUMPS INC.
Seneca Falls
New York

SALES OFFICES: Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburgh • Tulsa

Do the controls you specify carry these listings?

MERCOID PRESSURE AND TEMPERATURE CONTROLS

MERCOID TYPES DAE AND DSE
FOR HAZARDOUS LOCATIONS
N. E. CODE
Class I, Group D (NEMA 7)
Class II, Group E, F, G (NEMA 9, 9A)

ALSO
MERCOID TYPES DA AND DS
GENERAL PURPOSE
NEMA 1,
For indoor service and other general purpose applications

EQUIPPED WITH SEALED MERCURY CONTACT SWITCHES

Write For Catalog No. 856

THE MERCOID CORPORATION
4211 Belmont Ave., Chicago 41, Ill.

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Forms Nuclear International

The Martin Co., Baltimore Md., announces the formation of "Martin International," a wholly owned subsidiary company which will explore and develop world markets for nuclear powered electrical generating systems.

The firm says it is among the nation's first business establishments to embark on an international sales and promotion program aimed at harnessing the industrial atom for peacetime power. The program will concentrate particularly on those areas where power-starved nations are ready to bridge the gap from dependence on fossil fuels—coal, oil, and gas—to development of nuclear power.

LATEST CATALOGS

Industrial Oil Burner

A four-page bulletin describing a new industrial oil burner able to effect a 30 per cent saving in fuel costs by using heavy No. 5 oil is available from Industrial Div., York-Shipley, Inc., 500 Jessop St., York, Pa.

A page of detailed specifications is included. The unit is made in two sizes: 60 and 84 hp. A separate chassis for compressor and fuel-oil pump is said to simplify installation.

Kiln Instrumentation

"Modern Practices in Rotary Kiln Instrumentation", a 16-page illustrated folder, is being offered for distribution by the Leeds and Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.

The folder shows in photographs and diagrams how instruments and controls are used in the manufacture of cement, lime, and other non-metallic products. Pictures of actual on-the-job installations are used. Details of operation are discussed.

Cable, Supports, Fittings

Interlocked armored cable, supports and fittings are the subject of a catalog-type bulletin published by Natonal Electric Products Corp., Gateway Center, Pittsburgh 22, Pa.

Contained in the 24-page book are photographs and specific descriptions of the various types of Nepco-Lok armored cables available for voltages up through 15,000 v, single and multi-conductor. Arranged in table form are correlated listings of the most frequently used dimensional data, including conductor size, stranding, insulation, sheath and armor thickness, approximate outer diameter and weight per thousand feet.

Continued on Page 78

PREFERRED Limits and Fits for Cylindrical Parts

Developed for use wherever it might serve to improve and simplify products, practices, and facilities, this American Standard:

lists and defines the terms applying to fits between plain (non-threaded) cylindrical parts,

presents in tabular form the preferred basic sizes of mating parts, the preferred tolerances and allowances, and a series of standard tolerances so arranged that for any one grade they represent approximately similar production difficulties throughout the range of sizes,

recommends five types: Running and Sliding Fits, Locational Clearance Fits, Transition Fits, Locational Interference Fits, and Force or Shrink Fits,

gives the standard types and classes of fits on a unilateral hole basis so that the fit produced by mating parts in any one class will produce approximately similar performance throughout the range of sizes,

prescribes the fit for any given size or type of fit; also the standard limits for the mating parts which will produce the fit,

contains an appendix giving the limits of size for holes and shafts for additional classes and grades of fits which special conditions may require.

Diameters up to 200 in. are covered with sizes in accordance with the British, Canadian, and American agreements (to 20 in.) shown in bold face type.

B4.1—1955 $1.50

20% Discount to ASME Members

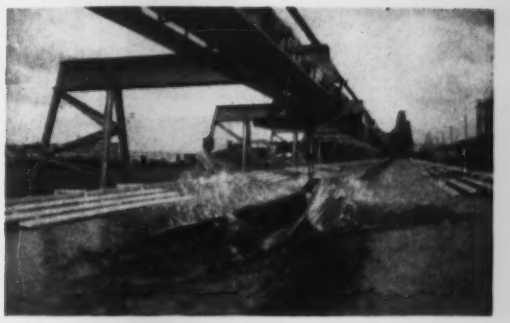
Published by

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

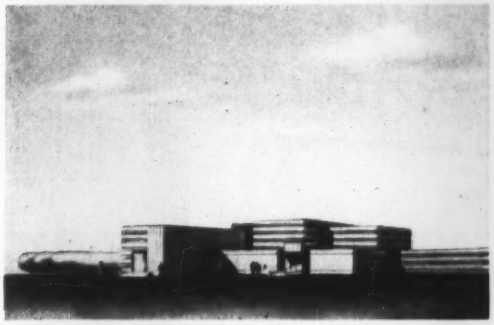
29 W. 39th St. N. Y. 18, N. Y.

Here's the big "PLUS" for engineers...

New $40,000,000 plant for Convair-Astronautics facility, soon to be completed.



New $300,000 Convair San Diego seaplane towing tank, first unit of complete hydrodynamics laboratory.



New $3,500,000 supersonic wind tunnel now under construction at Convair San Diego.

La Jolla Cove, one of many beauty spots within easy reach of San Diego.

the advanced projects and facilities, PLUS beautiful, year-round San Diego living

Tremendous projects at Convair San Diego include the F-102A Supersonic Interceptor, the Metropolitan 440 Airliner, the Convair 880 Jet-Liner, and a far-reaching study of nuclear aircraft. To aid engineers in these projects, big new facilities are being added to the already vast Convair San Diego plant. These include a huge installation for research, development, production and testing of the Atlas intercontinental ballistic missile, an elaborate new seaplane towing tank, and a new supersonic wind tunnel.

You'll find an ideal engineering "climate" at Convair San Diego – excellent salaries, comprehensive personal advantages, engineering policies to stimulate your professional growth, and a rewarding association with men who are outstanding in their engineering fields.

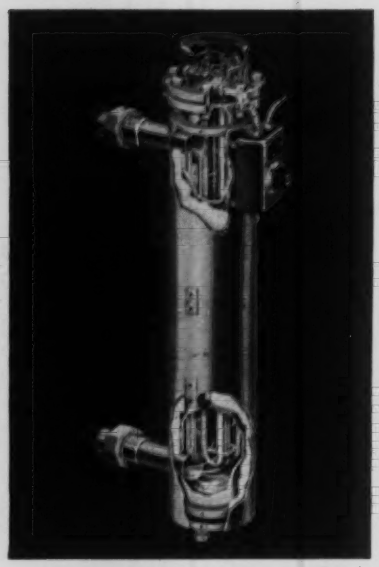
Add to all these the big "plus" of delightful living in sunny San Diego, where America's kindest all-year climate gives you and your family full enjoyment of beaches, mountains, desert resorts, Old Mexico, Hollywood, and many other fun possibilities. For the big "plus" in your future, send full resume to H. T. Brooks, Engineering Personnel, Dept. 625

CONVAIR

C-V GD

A DIVISION OF GENERAL DYNAMICS CORPORATION

3302 PACIFIC HIGHWAY · SAN DIEGO, CALIFORNIA



measured quantities of heat quickly • accurately to 750° F

CHROMALOX Electric CIRCULATION HEATERS

Used for preheating oil—heating water—generating, superheating and drying steam—heating process kettles and tanks—heating Dowtherm, Aroclor, Prestone and similar heat transfer liquids —heating air, nitrogen and other gases.

Easy to install, operate and maintain, these compact, packaged heating units are automatic and self-contained—with built-in heating elements, heating chamber, thermostat, and insulation. Provide dependable round-the-clock operation. Ideal for converting steam or gas-heated equipment to automatic electric operation.

Let the Chromalox Sales-Engineering staff solve your heating problems . . . electrically.

Write today for your copy of Bulletin 701

. . to get complete information on Chromalox electric heat exchangers and their applications.

For information on complete line of Chromalox electric heaters and controls—request Catalog 50.

Edwin L. Wiegand Company

7646 Thomas Boulevard, Pittsburgh 8, Pennsylvania

Edwin L. Wiegand Company
7646 Thomas Boulevard, Pittsburgh 8, Pa.

I would like to have . . .
☐ a copy of Bulletin 701.
☐ a copy of Catalog 50.
☐ a Sales-Engineer contact me.

Name _____
Company _____
Street _____
City _____ Zone _____ State _____

A-4476-A

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Epoxy Resin Adhesives

An 11-page technical bulletin giving engineering data on high strength epoxy resin adhesives for metal to metal bonding and honeycomb sandwich construction is available from Adhesives and Coatings Div., Minnesota Mining and Mfg. Co., 423 Piquette Ave., Detroit 2, Mich.

The bulletin contains information on five representative epoxy resin adhesives which, as a group, offer all the advantages of this type product. Uses of these five adhesives include: general purpose metal to metal bonding, honeycomb sandwich construction, permanent anchor for metal and plastic parts, tool repairing, sealer and crack filler.

Aluminum Electrode

A two-color folder describing "Low Amp" EutecTrode 2101 DC, a new electrode for aluminum featuring an extruded coating, is available from Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N. Y.

The folder, TIS2891, explains the advantages of an extruded coating over conventional hand-dipped coatings on aluminum electrodes. Photomacrographs show the differences between extruded and hand-dipped coatings. Other advantages covered in the folder are smooth, even transfer of alloy, greatly improved slag viscosity and solidification, absence of tailing and fingernailing and heretofore impossible weldability in all positions.

Corrosion Resistant Motors

A bulletin featuring the new Series 254-U all-weather rerated motors developed by Robbins & Myers, Inc., is available from the company's motor division, Springfield, Ohio.

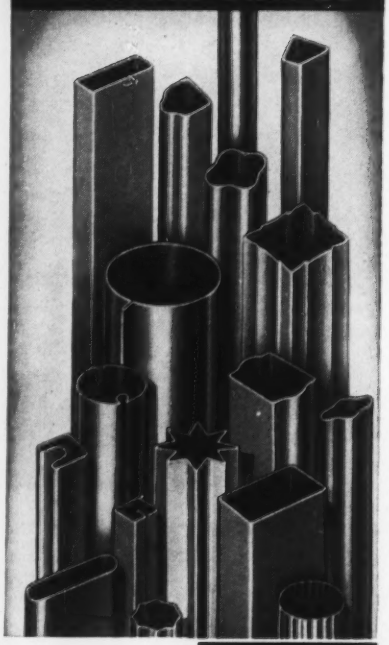
The eight-page bulletin describes the new motor's features, highlighted by a specially treated corrosion resistant steel housing which offers protection against all adverse weather conditions. Integral metal and cast iron parts are also given the anti-corrosion treatment. External design is such as to protect internal parts against entry of debris and other foreign objects.

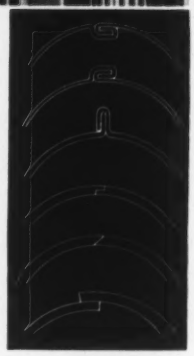
Shell Molding Process

"Plaskon Resins for Shell Molding," a 32-page illustrated booklet, has been issued by Barrett Div., Allies Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

The book describes the shell molding process for casting metals with particular emphasis on the foundryman's problems. This includes design and production considerations such as cost compared with other methods of producing castings; available types of molding machinery and factors in making a selection; gating techniques and precautions; pattern design; resin bonding of shell molds to insure tightness at the parting line; special metals handling; and sand reclamation.

COLD ROLL FORMING TUBULAR SHAPES





Among the wide variety of things you can make on a Yoder Cold Roll Forming machine are round, square, oval, rectangular and other tubular shapes, such as illustrated. The seams may be open, lapped, butted, dovetailed, interlocking, etc.—as shown in the drawing.

Millions of feet of such unwelded tubular shapes are made from coiled strip for conductor pipe, bedsteads, lamp stands, window channel, wiring raceways, carrying rods, etc. Production ranges from 20,000 to 50,000 feet per day, with only one operator and a helper.

Yoder offers you the cooperation of their engineering staff for designing and adapting their cold roll forming machines, auxiliaries, and tooling, for the low cost production of structurals, mouldings and trim, panels, tubular and other shapes, to meet individual needs.

The Yoder Book on Cold Roll Forming is a complete, illustrated text on the art and the equipment needed for performing a variety of operations which can be combined with cold roll forming, at little or no extra labor cost. A copy is yours for the asking.

THE YODER COMPANY
5499 Walworth Ave. Cleveland 2, Ohio

YODER — COLD-ROLL FORMING MACHINES

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Restrictor Tubing

Wolverine Tube, Div. of Calumet & Hecla, Inc., Detroit 26, Mich., announces a new leaflet for restrictor tubing.

The new promotional leaflet on Capilator, the capillary tube for restriction purposes, covers the advantages of plug drawn Capilator for metering flow of liquids and gases and highlights testing and control features, and what they mean for finished products in such industries as refrigeration and air conditioning.

Industrial Liquid Meters

A revised 16-page edition of the company's ER industrial meter bulletin, OG-400, offering additional information on factors affecting meter selection is available from Meter and Valve Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Included in the new bulletin are temperature, viscosity, pressure, and registration data along with additional illustrations, an explanation of various metering terms and explicit ordering instructions. The bulletin describes oscillating piston meters and offers data on meter construction—explaining, with the aid of tables and charts, which case, piston and chamber are best suited for use with specific liquids.

Bagging Scale

Construction, operating rates, and economy features of a new multipurpose open type bagging scale are described and illustrated in a two-color, six-page bulletin, No. 0256, offered by Richardson Scale Co., Clifton, N. J.

The bulletin discusses the firm's automatic bagging scale, which is designed to handle all nondusty materials, including grains, crumbles, pellets, and range cubes to 2½ in., in 25, 50, and 100-lb weighings. A complete operating cycle is described, along with scale accuracy to within 1 or 2 ounces and bagging rates of 12 to 15 bags per minute, depending on material.

Annunciator Systems

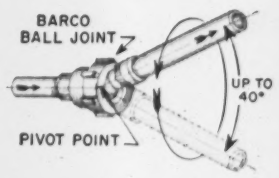
Scam Instrument Corp., 1811 W. Irving Park Rd., Chicago 13, Ill., has issued a catalog of its self-policing visual and audible annunciator systems.

In addition to listing the firm's De-Line, Du-All, S Line and Explosion Proof alarm systems, the catalog contains information on what to consider when selecting an annunciator, wiring diagrams for alarm units, sample alarm sequences which may be common to many plants and other engineering and installation data. The firm's accessories are also presented in the book.

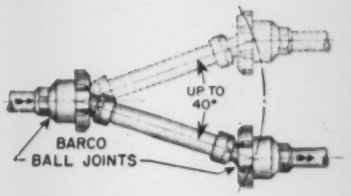
Use a CLASSIFIED ADVERTISEMENT
for Quick Results

How Barco Ball Joints Solve Piping Flexibility Problems

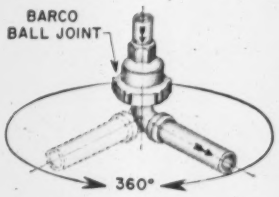
FOR TEMPERATURES UP TO 1000° TO 1200°F.



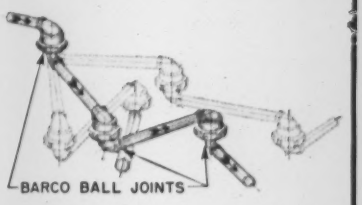
ONE JOINT—Provides for angular motion or positioning of piping in any plane. (Also see below.)



TWO JOINTS—This arrangement provides for piping alignment or simple flexible connection.



ONE JOINT—Allows for full 360° swivel or swing motion, in addition to angular movement shown above.



THREE (OR MORE) JOINTS—For complete flexibility. Any angle! Any radius! Any plane! Many arrangements possible.

In Power, Process, and Heating Service

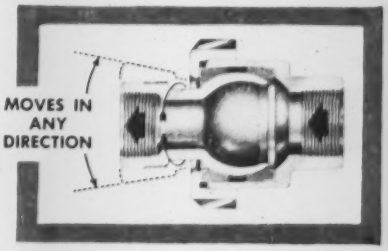
CERTAIN distinctive characteristics and features make Barco Flexible Ball Joints particularly well-suited for solving many present-day power plant piping design problems, especially for *Steam Service:*

1. **Ability to handle compound movement (where twisting is combined with thermal expansion and contraction).**
2. **Virtually no deterioration. Able to stay in service for years without repairs or maintenance. No lubrication.**
3. **No heavy pipe anchoring required. No "end thrust" developed under pressure.**
4. **Maximum safety for high temperature applications. All-metal construction. Special metals can be specified.**
5. **Basic design is pressure sealing against leakage and self-adjusting for wear.**
6. **Easy to engineer joints into piping to provide for any degree of flexibility, expansion, or movement required.**

GET THE FACTS — New Catalog 215B is an interesting, illustrated handbook on the application of Barco Flexible Ball Joints. Send for your copy NOW.

FOUNDED 1938
BARCO
PRODUCTS BACKED BY EXPERIENCE

BARCO
Manufacturing Co.
521-B NORTH HOUGH STREET
BARRINGTON, ILLINOIS



KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

One-Shot Lubricators

Detailed description, operation, and service of push-type semi-automatic lubricators are included in a two-page, two-color service instruction sheet offered by Bijur Lubricating Corp., Rochelle Park, N. J.

Two models of Bijur's one-shot lubricators are described in the sheet. Model HIA has a one-pint capacity reservoir. Model JIA has a two-pint reservoir. Both units are actuated by a spring discharge piston pump, that feeds oil into a distribution system to lubrication points. The firm says one-shot lubricators are used on machines requiring closely controlled but infrequent oil feed, including textile machinery, small punch presses and special types.

Scientists ...

Engineers

A suggestion from Dr. Robert J. Creagan, Project Manager

Westinghouse Commercial Atomic Power

"The physicist's role in the development of nuclear reactors is in analytical and experimental reactor physics, studying the problems of steady state reactivity and of reactor kinetics.

"In addition, reactor control problems with respect to transients are important. The reactor control must be integrated with the transient response of the entire power plant. Mathematical analysis using analog and digital computers is an important part of the work. We'd welcome an opportunity to discuss these interesting phases of our work with you."

An Experienced, Young, Fast-Growing Team

CAPA—Commercial Atomic Power Activity—is the most dynamic new division at Westinghouse. We're "fluid," not fixed. Supervisory jobs open up fast!

Our growth curve is bound to be *steep*—as electric power demand and atomic power production pyramid sharply. We're entirely *commercial*—not dependent on government contracts. Opportunities for advanced study at company expense. Get in on the "industry of tomorrow" *today*—at Westinghouse CAPA.

Immediate openings

. . . for Physicists • Physical Chemists • Chemical Engineers • Mechanical Engineers • Electrical Engineers • Designers • Metallurgists.

Send résumè to:

C. S. Southard, Westinghouse Commercial Atomic Power, Box 355, Dept. 123, Pittsburgh 30, Penna.

WESTINGHOUSE

FIRST IN ATOMIC POWER

Plastics Reference File

A revised 1957 edition of the "Condensed Reference File of Bakelite Plastics" has been published by Bakelite Co., Div., Union Carbide and Carbon Corp., 30 E. 42 St., New York 17, N. Y. The firm supplies six of the major types of plastic currently used by industry in more than 50 different forms.

The 16-page booklet includes distinguishing characteristics, appropriate fabricating techniques, and major fields of application for each group of plastics. These groups include polyethylenes, vinyls, phenolics, styrenes, epoxies, and polyesters. More than 80 photographs and sketches illustrate some typical and proper uses of the materials.

Combustion Process

A special combustion process for industrial furnaces is the subject of a new four-page bulletin published by Steel Processing Co., 212 Wood St., Pittsburgh 22, Pa.

The process is said to be applicable to new or existing heat treating furnaces, drying ovens, soaking pits and forging furnaces. Uniform temperatures throughout the furnace, low fuel consumption and single-point control are features.

Missile Fabrication

A 20-page bulletin outlining the engineering and manufacturing qualifications of Alco Products, Inc. as a missile fabricator is available from the company, Box 1065, Schenectady, N. Y.

The two-color publication details the firm's role as a major defense supplier, experience that dates to 1860 and includes more than $700 million in defense contracts in the last five years. The company lists among its capabilities as a supplier to the missiles field the company's close interest and association with electronic developments, its basic research facilities, and the acceptance of its thermal engineering systems by a variety of industries.

Metal Hose, Tubing

A catalog, G-560, which simplifies selection and ordering of metal hose and tubing for industrial equipment and maintenance applications has been released by American Metal Hose Div., American Brass Co., 666 So. Main St., Waterbury 20, Conn.

The 64-page publication provides design suggestions on planning flexible metal connector applications. Included are metal hose and tubing specifications, bend diameters, lengths, types, construction diagrams and descriptions of end fittings. Descriptions are included for hose and tubing available from the company made of bronze, brass, steel, stainless steel, aluminum, monel, super nickel, other metals, and with certain plastics.

Continued on Page 82

OOPS!

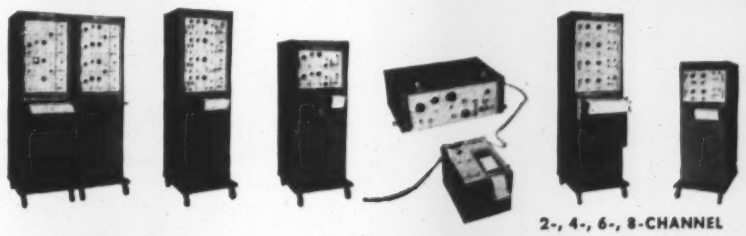
SIGHTS of rockets swooshing heavenward become more and more familiar as we thumb through today's industrial publications. The recalcitrant rocket shown on this page indicates that things *can* go wrong in research, and we don't claim that the absence of a Sanborn oscillographic recording system somewhere along the line was the reason for this disappointing trajectory.

What we do wish to say is that Sanborn equipment is playing an increasingly vital part in rocket development. Used in the laboratory to record flight behavior simulated by analog computers, and in plotting rooms at testing bases to tape down telemetered data, Sanborn "150's" are helping rockets to get and stay where they belong.

You can see Sanborn systems in many other places, too. Oil fields, electronic component production lines, machine tool plants, hydraulic testing laboratories, numerous aircraft manufacturers, computing facilities . . . are putting single to 8-channel Sanborn systems to work. (Most are housed in vertical mobile cabinets, while those in the "field" are often divided into portable packages for each instrument.) All of them give their users inkless, permanent recordings in true rectangular coordinates, one percent linearity, as many as nine chart speeds, and the efficiency (and economy) inherent in Sanborn unitized design. A dozen different plug-in preamps further extend their value, by making change-over to new recording inputs a quick and easy procedure.

SANBORN COMPANY

CAMBRIDGE 39, MASSACHUSETTS



8-, 6-CHANNEL 4-CHANNEL 2-CHANNEL 1-CHANNEL 2-, 4-, 6-, 8-CHANNEL ANALOG COMPUTER SYSTEMS

Which way rockets are going may not be a primary concern of yours. But if recording problems are, you're apt to find some interesting and useful answers in Sanborn's 16 page "150 System" catalog. Write to us for a copy.

Designers

OPERATION TELEPHONE

may introduce you to

unusual advancement opportunities

Across the nation, we have talked by phone with men who have expressed interest in our design work. Easily, quickly they have been able to get the important facts on our attractive career opportunities

If *you* are restless — perhaps in a deadend job — mail the coupon *immediately*. Chances are we will call you shortly — give you an opportunity to verbally investigate what we have to offer.

Ability shows up fast in our design work. Some of our top men, with top earnings and responsibility, are comparatively young. It could happen to you.

Be sure to give us your home telephone number

Mr. E. M. Peterson, Office 35, Design Employment
Pratt & Whitney Aircraft, East Hartford, Conn.

I would like to learn more about your openings for product and component designers. My experience has been in the following fields:

☐ Nuclear Design	☐ Aerodynamics	☐ Bearings
☐ Compressors	☐ Hydraulics	☐ Piping
☐ Turbines	☐ Gears	☐ Controls
☐ Structures	☐ Valves	☐ Test Equipment
☐ Afterburners and Related Equipment	☐ Heat Exchangers and Combustion Problems	☐ Test Rigs

Total years Mechanical Design experience .....

You can reach me at ..... (home telephone) Most convenient hours for receiving calls are between ..... and .....

NAME .....

HOME ADDRESS .....

CITY ..... STATE .....

PRATT & WHITNEY AIRCRAFT

DIVISION OF UNITED AIRCRAFT CORPORATION EAST HARTFORD 8, CONNECTICUT

World's foremost designer and builder of aircraft engines

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Temperature Regulators

A folder describing the construction and function of its 650 series of temperature regulators is being offered by Atlas Valve Co., 280 South St., Newark 5, N. J.

The regulators, all featuring a balanced type of construction, are vapor pressure operated. They are available in either single seat design for tight shut-off, or double seat design for continuous operation, both direct and reverse acting. The regulators are suitable for controlling initial temperatures from 60–240 F in increments of 40 deg feature an accuracy range of ±3–5 deg.

Fiber, Laminated Plastics

A comparator chart, listing property values of laminated plastic and vulcanized fiber in a comparison evaluation, has been issued by National Vulcanized Fibre Co., 1056 Beech St., Wilmington 99, Del.

Thirty-four basic grades of vulcanized fiber and phenolite laminated plastics are compared. Twenty-three material property ratings are given for each grade. Materials are rated as excellent, good, fair, and poor. The chart gives the comparative price for each grade.

Corrosion Resistant Equipment

A 32-page catalog covering the corrosion-resistant plastic equipment of Haveg Industries, Inc., Wilmington, Del., is now available. The catalog covers synthetic resin formulations, and such newer products and materials as glass reinforced polyester, polyvinyl chloride and Teflon equipment.

Also included are pipes and fittings, valves; fume ducts and fume systems; tanks, towers, and accessory supplies; heat exchangers; pressure and vacuum equipment; and agitators. The booklet includes data on chemical-resistant cements, the field construction of plastic equipment, and the firm's design service.

UNITED

UNITED COMMUNITY CAMPAIGNS

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Optical Tooling Instruments

Charles Bruning Co., 100 Reade St., New York 13, N. Y., has issued a 20-page catalog, A-2230, covering optical tooling instruments.

Included are examples of how optical tooling is being used for measurement in industry and photos and explanations of optical transit squares, tooling bars, alignment scopes, jig transits, accessories, and attachments.

Proportioning Pump

Design features said to contribute to exceptional feeding accuracy, positive feed rate setting, and the initial and operating economies of Model 1140 proportioning pump are described in a bulletin prepared by Proportioneers, Inc., Div. of B-I-F Industries, Inc., 345 Harris Ave., Providence, R. I.

The bulletin contains photos, capacity charts, dimension drawings and text showing how the unit, either in its simplex or duplex style, is suited for proportioning in chemical or general industrial fluid applications over a wide range of capacities and pressures. The unit handles feed rates from 0.8 gph to 900 gph at discharge pressures up to 1340 psig.

Dripproof Motors

Bulletin GEA-5980, a 12-page publication illustrating production testing techniques and construction features of 1 to 5 hp dripproof and enclosed motors, is available from General Electric Co., Schenectady 5, N. Y.

Machinery Mounts

An illustrated data sheet, K2D, describing vibration and noise absorbing machinery mounts utilizing Elasto-Rib, is available from The Korfund Co., Inc., 48-35N 32nd Place, Long Island City, N. Y.

The sheet gives information on properties, and construction and installation of these dampers. Dimension and loading capacity tables are included.

Exhaust Systems

A comprehensive brochure on the subject of corrosion-proof ventilating and exhaust systems, has been released by the American Agile Corp., 5461 Dunham Rd., Maple Heights, Ohio.

The 12-page literature covers such items as thermoplastic corrosion-proof centrifugal fans, ducting and fittings, and hoods. A six-page section is devoted to a discussion of polyethylene and nonplasticized polyvinyl chloride centrifugal fans. Considerable attention is given to end functional figures and performances. Two pages detail various positions and arrangements to meet specific operating conditions. The brochure is augmented with more than three dozen illustrations.

Which V-Rings have the original Vee-Flex® design?

Appearance won't tell—performance will!

DESIGNED FOR EVERY PISTON AND ROD • ROCK-HARD RINGS • POLYMER SATURATED FABRIC • PRECISION TRIMMING • PROPER INTERFERENCE FOR AUTOMATIC SEALING

R/M Vee-Flex is so designed as to be self-sealing and self-adjusting. The surfaces of the rings have a convex curvature where they contact the ring adjacent. The hydraulic pressure stroke produces a seal laterally against the stuffing box wall and longitudinally against the next ring.

Deep, thorough penetration of the compound into the fabric of this top-flight packing enables it to provide maximum resistance to extrusion at high pressures. In addition, it is precision molded for better fit, longer service. Whatever your hydraulic application, you can count on R/M Vee-Flex for perfect performance.

R/M makes a complete line of mechanical packings, including Vee-Flex, Vee-Square, Homogeneous Vee-Rings, and Fabric Piston Cups

For complete information, send for booklet

R M **PACKINGS**

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, PASSAIC, N.J.

MECHANICAL PACKINGS AND GASKET MATERIALS

FACTORIES: Passaic, N.J.; Bridgeport, Conn.; Manheim, Pa.; Neenah, Wis.; No. Charleston, S.C.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Industrial Adhesives • Bowling Balls • Laundry Pads and Covers

Heat, Pressure Recorders

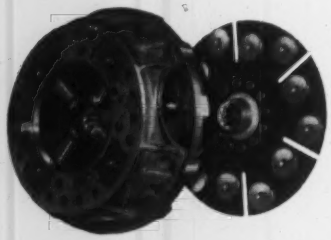
A new brochure of Burgess-Manning Co., Penn Instruments Div., 4110 Haverford Ave., Philadelphia 4, Pa., describes temperature and pressure recorders.

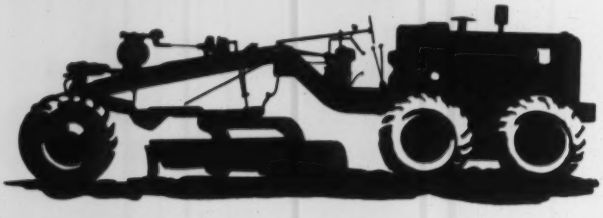
The brochure, No. 1021, describes the workings and advantages of the filled tube system recorders and lists six types of pens. In addition, there are illustrations of recorders including blueprints showing makeup, installation and operation, and drawings and text on the free-friction movement of the pen arms, the rigid girder assembly of the instruments and the "flooded cup" design. The booklet includes information on bulbs and sockets for gas-filled (class III) thermal systems, including symbol numbers, materials, and tube dimensions.

ROCKFORD

MORE

CLUTCH LIFE
TORQUE CAPACITY
HEAT RESISTANCE





Designed especially for use in heavy-duty, high-speed engine equipped machines such as trucks, tractors, earth movers, graders, shovels, cranes, dozers and oil field units—

New MORLIFE® CLUTCHES and CLUTCH PLATES Give-

MORE Clutch Life (400% MORE)
MORE Torque Capacity (100% MORE)
MORE Heat Resistance (50% MORE)

See this NEW type MORLIFE clutch at the Road Show in Chicago—or get full information how this clutch improves the operation of heavy-duty, off-highway machines, by writing Department E—

"MORLIFE clutch has gone 851 hours without slipping or adjustment."

"MORLIFE clutch going strong after 1695 hours, working in sand."

"MORLIFE clutches last 950 hours longer, without adjustment."

"MORLIFE clutch needs adjustment once a month, instead of daily."

"MORLIFE requires lighter handle pull and one tenth the adjustments."

"MORLIFE pulls harder and lasts six to ten times longer."

"Won't buy a unit that isn't equipped with Durable MORLIFE clutch."

ROCKFORD Clutch Division BORG-WARNER
1307 18th Avenue, Rockford, Illinois, U.S.A.
Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

Corrosion Control Tape

An eight-page illustrated booklet describing the advantages of Trantex polyvinyl tape for covering and protecting pipes, valves, frames, racks and metal surfaces against corrosion both above and below ground has been published by Dutch Brand Div., Johns-Manville, 7800 S. Woodlawn Ave., Chicago 19, Ill.

The booklet tells how the tape protects and resists corrosion from weather, acids and and alkalies, micro-organisms, soil chemicals, and stray electrical currents. It is complete with illustrations, technical data, characteristics, and performance specifications. Descriptive text, drawings and photos are included.

Laminated Plastic Parts

A 12-page booklet entitled "Fabricated Parts and Components . . . Management Decision For Profit" is available from National Vulcanized Fibre Co., 1056 Beech St., Wilmington 99, Del.

The booklet deals with the cost advantages gained by dealing with a single responsible source for fabricated parts made from vulcanized fiber, phenolite laminated plastic, nylon and combinations of these materials. Thirty-six illustrations are used to show machining operations and products made. Property and application charts are included.

Air Atomizing Burner

A bulletin, AD-158, said to describe the first low-pressure air atomizing burner of its type, has been announced by the Hev-E-Oil Burner Div., Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12, Wis.

Designed to burn low cost residual oil, at low pressure, the new AM8E burner is rated at 90 gph. High quality components which include the latest type of combustion controls are standard equipment, the company reports, and the controls offer complete protection under all conditions. The burner uses No. 6 fuel oil.

Packaged Dryer

An eight-page bulletin on the Dryalator, a packaged device for automatically drying lumber, is now available from Orr & Sembower, Inc., Morgantown Rd., Reading, Pa.

The unit is designed for use by lumber and furniture manufacturers and for manufacturers of products which incorporate components made of wood. The equipment dries lumber faster and at less cost than conventional kilns, according to the firm. The two-color bulletin, No. 1232, shows how the unit brings high speed automation to wood and lumber drying. Illustrations show the equipment, pneumatic recording controls, steam heating coils, instrumentation, and operating views of the kiln.

KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

High Pressure Pumps

Philadelphia Pump & Machinery Co., 13500 Philmont Ave., Philadelphia, Pa., offers a new catalog on its Series HP controlled capacity pumps for pressures to 35,000 psi, and capacities to 2000 gph.

Typical applications of the pumps are charging systems; pumping liquid oxygen at minus 340 F.; pulse generators in liquid extraction of metals; pumping liquid sodium; pumping additives to liquid isotopes; maintaining pressure head in hydraulic accumulator systems; flow blending in high pressure processing lines; pumping extremely viscous materials (to 30,000 SSV and greater).

Radiant Tube Burner

A gas burner designed to increase the versatility of radiant tube industrial heating installations is described in a catalog, No. H-46, issued by Eclipse Fuel Engineering Co., Rockford, Ill.

Including specifications and dimensional diagrams, the catalog lists the optional range, tube size, regulation and ignition features. The burners are for use with metal or ceramic radiant tubes in industrial ovens, furnaces and muffles. They are sealed, nozzle mixing burners mounted directly on the tubes.

Heat Exchangers

Taco Heaters, Inc., 1160 Cranston St., Cranston 9, R.I., has available a comprehensive catalog on commercial and industrial heat exchangers.

Engineering and heating surface data is given, along with diagrams and specifications on converters, water heaters, instant heaters, external storage heaters, straight tube heaters, tanks, heating units, condensate coolers, fuel oil heaters.

Guide to Spring Design

The fundamentals of spring design are set forth in a new eight-page brochure, "Spring Design and Selection—in Brief," published by Associated Spring Corp., Bristol, Conn.

The brochure contains the basic stress and deflection formulas, the commonly used spring materials, typical applications, and certain limitations for each of the various types of springs—round wire compression springs, square wire compression springs, rolled or rectangular wire compression springs, volute springs, conical compression springs (single and double taper), high duty compression springs (such as valve springs), torsion bars, extension springs, round and rectangular wire torsion springs, cantilever and elliptical type flat springs, spiral or brush springs made of flat wire, control springs, high temperature springs, clock or motor power springs, Belleville spring washers, curved spring washers, wavy spring washers, and hair-springs.

Process Instrumentation

Fischer & Porter Co., 907 Jacksonville Rd., Hatboro, Pa., manufacturer of process instrumentation, has published a 32-page catalog describing the company's products which are available for immediate shipment.

The catalog, which includes prices, covers indicating, recording, controlling, and transmitting instruments for flow, pressure, and density.

Zeolite Softeners

Cochrane Corp., 17th St., Philadelphia 32, Pa., announces a 20-page Bulletin, No. 4520, dealing with the necessity for water softening, explaining the fundamentals of softening and selection of equipment and zeolites.

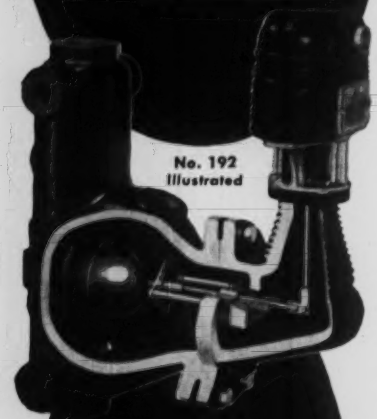
The bulletin also describes the operation of the firm's hydromatic valve for manual or automatic control of the cycling of the process.

BOARDMASTER BY UNIVERSAL

The volume of engineering design requires the selection of properly engineered drafting machines. Universal's Boardmaster offers ten major advantages, including Ball Bearing Indexing, Unlimited Protractor Visibility and Positive Baseline Control. We invite you to study this information. You may well discover that the long-time economy of Boardmaster drafting machines justifies the replacement of less efficient equipment. Write for folder, "More For Your Money".

UNIVERSAL DRAFTING MACHINE CORPORATION
7960 LORAIN AVENUE, CLEVELAND 2, OHIO

Yes...
McDONNELL CONTROLS FOR BOILERS TO 250 psi.



McDONNELL
92 SERIES
Pump Control, Cut-Off and Alarm Switch
Underwriters Listed

Here's a whole new concept of control design and performance — with the best-known name in its field. Introduces repulsion magnetic switching for positive opening and closing. Beats the heat as never before — okayed for 75° C. (167° F.) wiring. Has extra generous float clearances, operating levels that are not affected by pressure changes; and a host of other refinements.

Write for Bulletin L-123

Shows 92 Series models with or without integral water column. Has full engineering data for controlling pumps or electric valves on boiler or tanks, for low water cutoff and alarm, etc.
Also shows companion 91 Series, for pressures to 150 psi.

McDONNELL & MILLER, INC.
3510 N. Spaulding Ave., Chicago 18, Ill.

McDONNELL
Boiler Water Level Control

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Grinding Wheel Adapters

An eight-page catalog featuring its line of grinding wheel adapters and tool room and grinding room accessories has just been issued by Wm. Sopko & Sons Co., 140 E. 267th St., Euclid 32, Ohio.

Illustrated are four styles of adapters for wheels from $\frac{1}{2}$ to 2 in. in width, with both LH and RH threads. They may be used on over 25 different makes of popular surface tool and cutter grinders, the firm states. Also catalogued is a long extended type adapter, as well as reversible wheel adapters designed for diamond wheel use. Other items shown are a combination spanner and socket wrench, puller bushing and screw lock washers, adapter nuts, truing arbors, quills, thin head ground wheel screws, spindle belts.

Automatic De-Sludgers

A bulletin describing continuous self-cleaning separators, clarifiers and extractors with automatic sludge discharge, has been announced by Centrico, Inc., 75 W. Forest Ave., Englewood, N. J.

Particularly suitable for processing liquids that have too high a solids content for conventional separators with solid wall bowls, the Westfalia de-sludgers perform such operations as purification, separation, clarification, polishing and de-watering for a wide variety of industrial applications, the booklet reports.

Paperwork Reduction

An illustrated eight-page brochure, which describes how diazotype copying machines are being used to eliminate up to 90 per cent of the writing in preparation of production and assembly orders, has been published by the Charles Bruning Co., 4700 Montrose Ave., Chicago 41, Ill.

The brochure shows step-by-step how a translucent operations sheet is converted into a parts production order by use of a low cost copying machine, eliminating rewriting and proofreading of descriptions, specifications, and work instructions. The application of mechanical copying in the preparation of sub-assembly and final assembly orders is also explained.

Feed Pump Film

The construction and ease of maintenance of Allis-Chalmers barrel type boiler feed pump is graphically portrayed in a new 16 mm color sound motion picture now available to interested groups.

The film shows the manufacture of the pump, including radiographic inspection with the betatron, parts machining and performance tests. Also portrayed is the simplified design and ease with which the pump can be dismantled by means of standard equipment for inspection of operating parts.

Requests for showing of "Barrel Type Boiler Feed Pump," which runs 20 min, should be made to the nearest Allis-Chalmers sales office.

LOW COST
ACME NUTS
& TAPPED PARTS
H&R
The Threading Specialists

Specialists in Acme tapped parts for 21 years, H & R offers top quality, prompt delivery at substantial savings:

★ SPECIALIZED TOOLING cuts production costs, gives you finer finishes, closer tolerances.

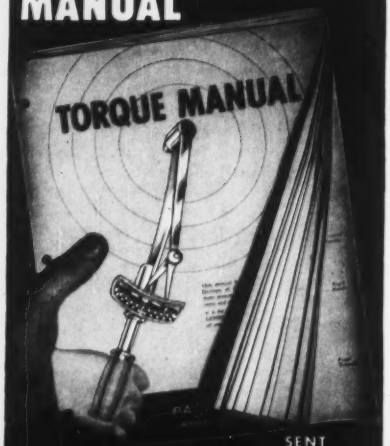
★ LOWER TOOLING COST— usually "off the shelf" at H&R!

Get the facts about H & R Acme threaded parts now. Send sketch or drawing — let us show you what we can do to cut your costs!

19

HORSPOOL & ROMINE
MANUFACTURING CO., INC.
5850 MARSHALL ST., OAKLAND 8
TELEPHONE OLYMPIC 2-1844

"TORQUE WRENCH" MANUAL



SENT UPON REQUEST

Formulas
Applications
Engineering Data
Screw Torque Data
Adapter Problems
General Principles

PA STURTEVANT CO
ADDISON QUALITY ILLINOIS
Manufacturers of over 85% of the torque wrenches used in industry

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Magnetic Shielding

A 33-page technical brochure entitled Data Sheet 101, describing construction features, performance characteristics and typical applications of nonshock sensitive nonretentive Fernetic and Co-Netic magnetic shielding material has been released by Magnetic Shield Div., Perfection Mica Co., 20 N. Wacker Drive, Chicago 6, Ill.

Included are 12 pages of technical data, five pages of performance graphs, 14 pages of illustrations and a two-page comprehensive index.

Coke Dust Control

Wheelabrator Corp., 1149 S. Byrkit St., Mishawaka, Ind., has a booklet available on the control of dust from coal and coke handling operations.

It discusses the use of local exhaust ventilation and cloth-tube-type dust collectors. This method is said to be applicable to such operations as the conveying and preparation of coal for burning in industrial plant or power plant furnaces and boilers; the conveying, screening, and weighing of coke for charging foundry cupolas; the conveying, screening, crushing, weighing, and batching of coal in chemical processing.

Clutch Manual

Marland One-Way Clutch Co., LaGrange, Ill., announces release of an engineering manual and catalog.

Included are automatic freewheeling clutches; combination clutch-couplings; back-stops to prevent reversed runaway of inclined conveyors or vertical elevators; and a new line of completely enclosed freewheeling clutch units for continuous operation under extremely adverse conditions. The manual contains 110 illustrations, part in full color, together with explanatory schematic lay-out drawings.

Cold Welding Film

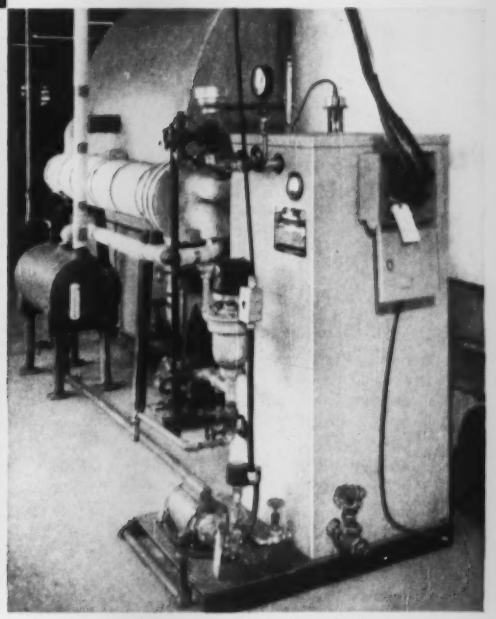
"Cold Welding", a new 16-mm sound movie and 10-min documentary account of maintenance welding operations at Thule Air Base, Greenland, has been produced by Technical Information Service, Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N. Y.

The film depicts the activities of several of the firm's welding technicians who were flown to provide on-the-spot recommendations for repairing diesel generator cylinder walls and other heavy equipment.

The welding operations shown take place 900 miles from the North Pole. The use of the firm's "Low Heat Input" metal-joining and repairing process is shown. Cold welding procedures for repair of the diesel engines, for 350 cylinder liners costing about $1000 each delivered in Thule and for such applications as repair of diesel engine radiators and aircraft fuel tanks are featured.

Pantex
Speedylectric Steam Generator

Ideal Steam Source for Production Processes



Speedylectric Steam Generator supplying heat to waxer.

Manufacturing huge quantities of waxed paper containers of every size and shape, a nationally-known company needed a reliable source of heat for a production step in which the new containers are deeply impregnated with a special hot wax. Here, as in many manufacturing processes, a Pantex Speedylectric Steam Generator was the answer.

In the impregnation process, accurate control of wax temperature and submersion time is required for dimensional control of the finished product, complete wax penetration and stability of ink colors. The use of a Speedylectric Steam Generator as a heat source not only assures reliable temperature control at modest cost, but eliminates all danger of fire or explosion . . . serious hazards where the plant atmosphere is often full of particles of waxed paper.

Wherever a reliable, convenient, safe source of steam is needed, Speedylectric Steam Generators serve industry. Using a unique electrode method to generate steam, and easily portable, they require no supervision, operate without flame or fumes, and eliminate the risk of fire or explosion.

WRITE TODAY FOR COMPLETE FACTS AND FIGURES

Speedylectric Steam Jet Cleaners, too, serve industry in countless ways. High pressure jet of dry steam and solvents quickly removes grease and dirt accumulations from machines and equipment without flooding floors. No need to stop nearby production or move machines outside. Completely safe and portable.

PANTEX MANUFACTURING CORPORATION
Box 660AJ, Pawtucket 1, R. I.
Send me facts and figures on:
☐ Pantex Speedylectric Steam Generators
☐ Pantex Speedylectric Steam-Jet Cleaners

Name and Title _____

Company _____

Address _____

KEEP INFORMED

NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Scraped Surface Chillers

Henry Vogt Machine Co., Box 1918, Louisville, Ky., has issued a four-page folder on scraped surface chillers for direct expansion refrigerant service.

According to the bulletin, a new integral design provides an extra rigid scraper driver with reduced installation and maintenance cost. Each 24-in. shell contains seven 6-in. scraped pipes arranged for seven-pass series flow. Nozzles can be furnished between any passes to provide for incremental solvent dilution.

Carbide Blank Prices

A new price list covering made-to-order Carboloy carbide blanks is announced by General Electric's Metallurgical Products Dept., Detroit 32, Mich.

The new publication, which reflects latest carbide prices, covers semi and modified standard cemented carbide blanks as well as solid cemented carbide cylinders. The 35-page publication is referred to as GT-314. It includes "how to order" instructions, and specifies shapes subject to extra charges.

Mechanized Heat Treating

A bulletin explaining the economic features of completely mechanized heat treat lines is available from Surface Combustion Corp., Toledo 1, Ohio.

Twenty-four basic furnace mechanisms are shown with isometric drawings. Photos and diagrams illustrate the steps to be used in building automated lines to insure better end product quality with absolute accuracy. The bulletin is designated SC-176.

Fluid Drives

An eight-page illustrated two-color catalog, A-119, covering Type VS Class 2 Gýrol fluid drives in the $7\frac{1}{2}$ through 800 hp range is now available from American Blower Corp., Detroit 32, Mich.

Advantages and applications of adjustable speed Gýrol drives are thoroughly discussed in the new bulletin. A description of construction features is accompanied by an example of how these units operate. A cutaway view of a typical unit is included. Selection tables covering the full line of adjustable speed drives are also included.

Hermetically Sealed Switches

Haydon Switch, Inc., Waterbury, Conn., has issued Catalog No. 5, covering hermetically sealed switches.

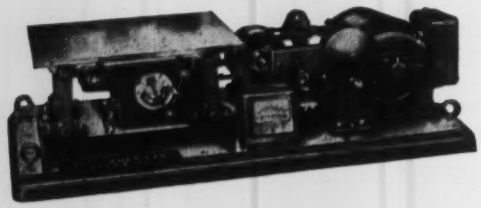
Included are subminiature switches, the standard single blade, double blade, and special switches designed for custom applications. Also included are standard and special actuators. Data is given on component and electrical specifications of each switch. Typical schematic drawings are included for each series with engineering data.

Silicone Reference Guide

A 1957 reference guide to silicones has been published by Dow Corning Corp., Midland, Mich. Almost 150 commercially available silicone products are described in the catalog, including several which were developed within this last year.

Products are grouped by usage. Descriptions are brief and factual, with emphasis on charts, tables and graphs directly comparing various silicones with the materials they are displacing. It is illustrated with application photographs.

Parts, Assemblies, Up to 150 lbs. Given Vibration Fatigue Test on the ALL AMERICAN Model 150 HLA-D

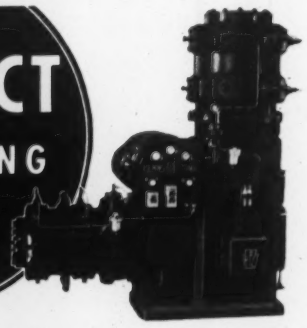


This machine, subjects parts or assemblies, up to 150 lbs. in weight, to a comprehensive vibration fatigue test. It has a 50% overload safety factor. Vibration in simple harmonic motion is produced horizontally. Displacement (double amplitude) is adjustable from 0″ to .125″. Automatic Range Selector controls acceleration and deceleration. From 10 cycles per second frequency may be increased uniformly to 60 c.p.s. and then decreased to 10 c.p.s. Any desired range within the total may be selected. Selector can be switched off and frequency held at any c.p.s.

Recommended for testing aircraft, electronic, electrical, mechanical or optical parts or components. One of 7 models. Send for Catalog F, containing helpful data, nomograph chart and listing typical users. Write to

ALL AMERICAN TOOL & MFG. CO.
8019 LAWNDALE DRIVE, SKOKIE, ILLINOIS
Makers of All American Precision Die Filing Machines

COMPACT SPACE-SAVING DESIGN



PPC

PACKAGE DESIGN • READY TO RUN

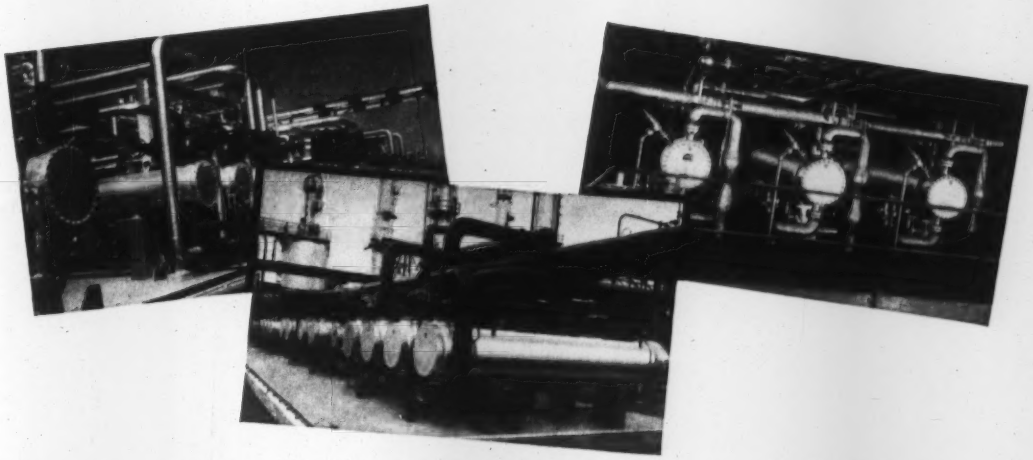
Class* HAE ANGLE TYPE *Compressors

- PACKAGE DESIGN makes close quarter installation practical.
- FOUNDATION—A small foundation is all that is required. Installation and relocation a minor matter.
- BUILT-IN MOTOR requires no foundation.
- BUILT-IN INTERCOOLER with automatic drain. Full force feed lubrication to frame and cylinders. Automatic shut down in event of oil failure.
- AIR CUSHION VALVES constructed without bolts, nuts or screws to work loose or burn fast, are noted for long life and tight seating qualities.

Write for Descriptive Bulletin HAE

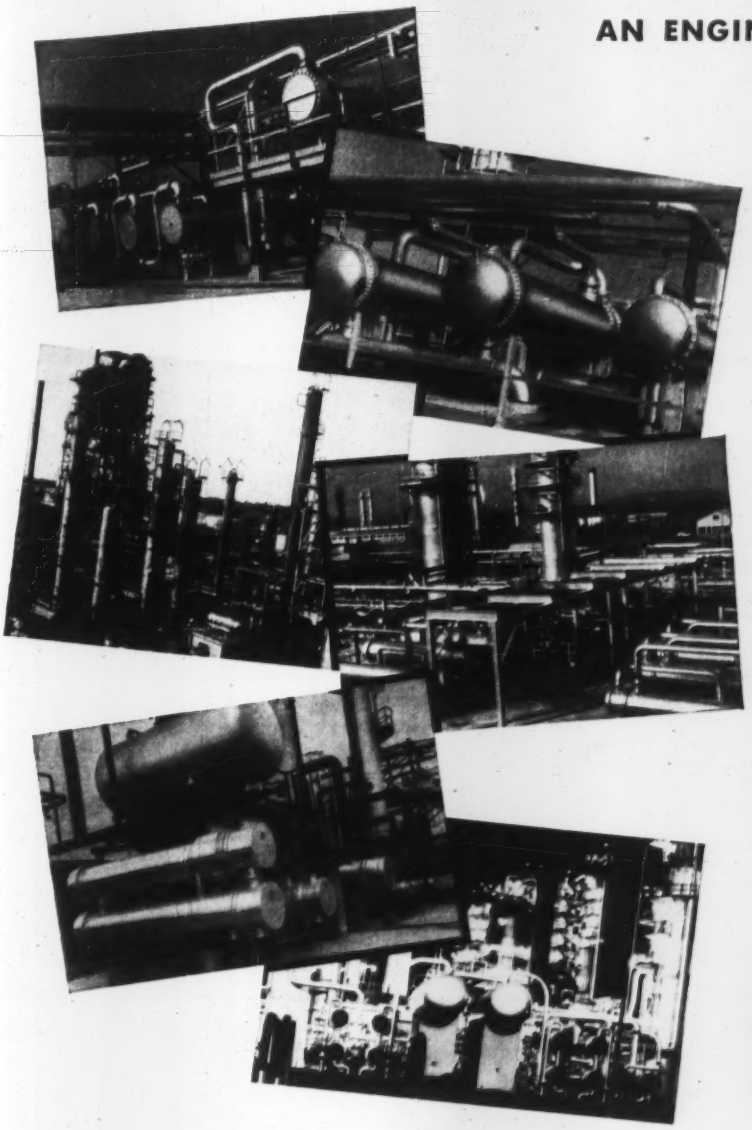
PENNSYLVANIA PUMP AND COMPRESSOR COMPANY
Main Office and Works: Easton, Penna.
Earning Confidence Since 1920
E-PP343-1156

PENNSYLVANIA PUMP AND COMPRESSOR COMPANY



what heat transfer characteristics are needed here...and why?

AN ENGINEERED ANSWER FOR YOU



In substance, and in nearly every instance, that's the question that's put to Ross.

It can apply to chemical processing, petroleum refining, power generation or nuclear energy... wherever specialized heat exchangers are indicated.

It may call for a highly complex design, high temperature or high pressure construction, special materials... a single unit or dozens of identical ones.

The point is that whatever the requirements, Ross will present you with a thoroughly considered, engineered answer. No one is more qualified to give it. No one is better equipped to deliver the finished product.

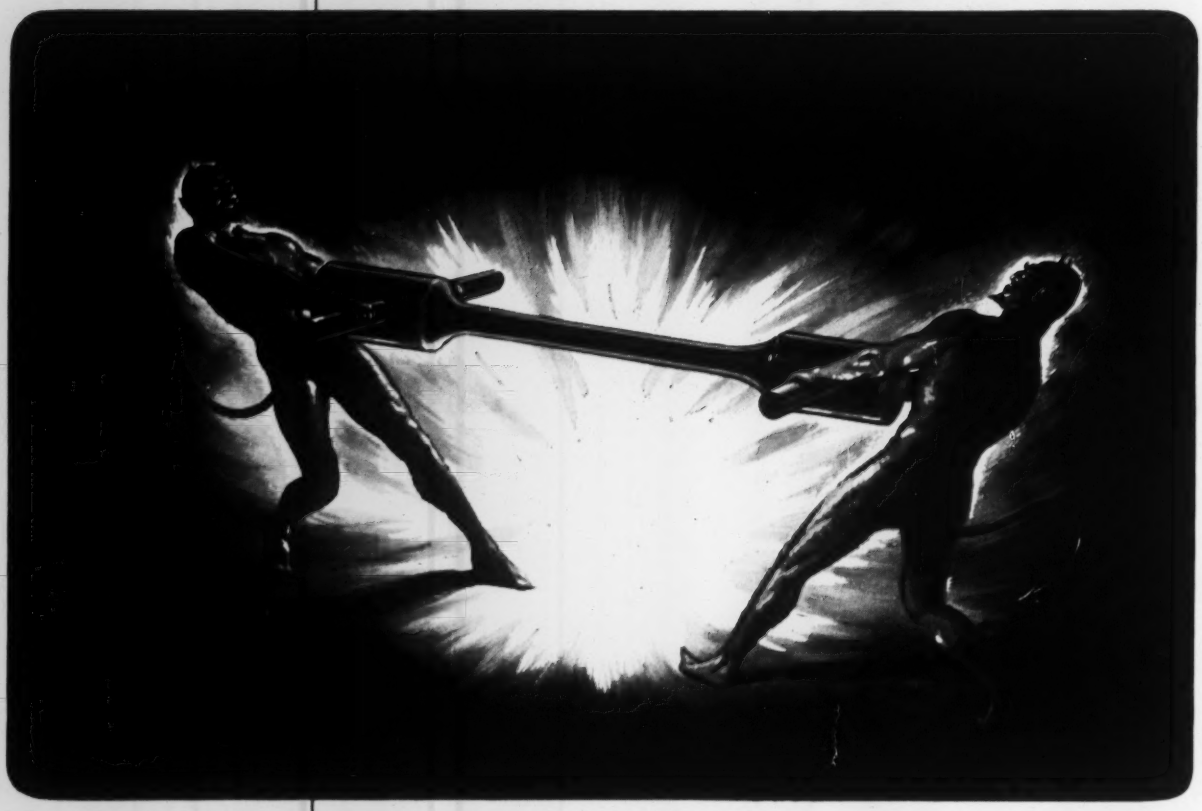
When you come to Ross for the engineering solution, of this you can be certain: your questions or those of your consultants will be answered with well qualified "reasons why," based upon vast experience in the specially engineered shell and tube heat exchanger field. Your inquiry will bring a nearby Ross representative promptly to your desk.

Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS

ROSS HEAT EXCHANGER PRODUCTS

IMPORTANT DEVELOPMENTS AT JPL



Material Testing at 5000° F.

The Jet Propulsion Laboratory is a stable research and development center located north of Pasadena in the foothills of the San Gabriel mountains. Covering an 80 acre area and employing 1600 people, it is close to attractive residential areas.

The Laboratory is staffed by the California Institute of Technology and develops its many projects in basic research under contract with the U.S. Government.

Opportunities open to qualified engineers of U.S. citizenship. Inquiries now invited.

The use of materials at extreme operating temperatures requires a knowledge of their properties at these temperatures. In order to determine the high temperature properties of graphite for use in jet vanes and nozzles, new testing equipment and techniques were needed.

For this purpose, the Jet Propulsion Laboratory successfully developed unique testing equipment using specially-designed graphite extensometers and spiral heaters capable of determining the stress-strain properties of graphite at temperatures in the vicinity of 5000° F.

Commercial graphite grades are now being evaluated for missile applications using this equipment. Concurrently a long-range investigation has been initiated to determine the effect of micro-structural variables upon the properties of graphite at extreme temperatures.

Supporting research of this type is a Laboratory "must," providing needed data for engineers concerned with the design of missile systems.

Qualified individuals interested in such stimulating activities will find rewarding careers in research and development at JPL.

JOB OPPORTUNITIES IN THESE FIELDS NOW

jpl

AERONAUTICS • MECHANICAL • STRUCTURES • DYNAMICS
PROPULSION • APPLIED MECHANICS • INERTIAL ELEMENTS
METALLURGY • CERAMICS • SOLID STATE PHYSICS

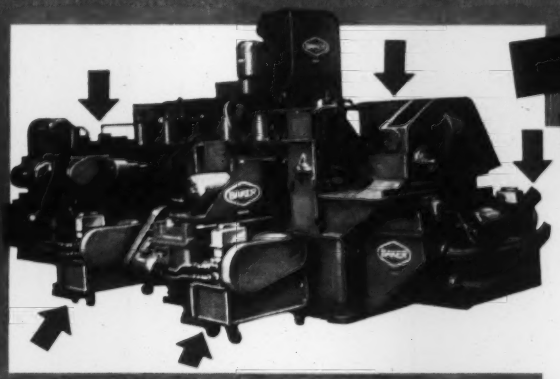
JET PROPULSION LABORATORY

A DIVISION OF CALIFORNIA INSTITUTE OF TECHNOLOGY

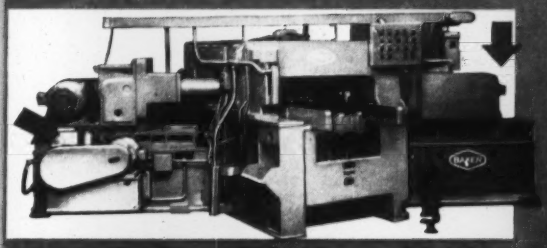
PASADENA • CALIFORNIA

OILGEAR "JK" FLUID POWER FEED PUMPS

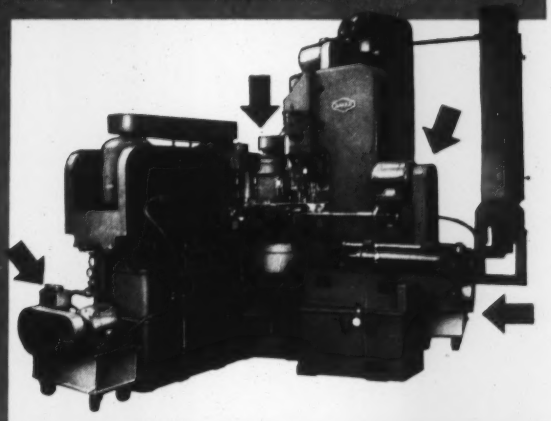
AS APPLIED TO BAKER BROTHERS MACHINES



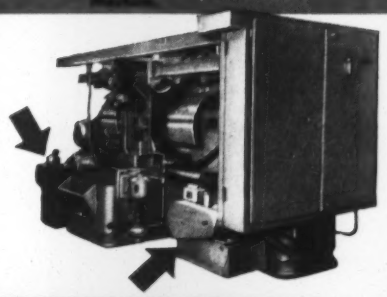
Five Oilgear "JK" Feed Pumps on Baker's Multiple Station Automatic Transfer Type Machine.



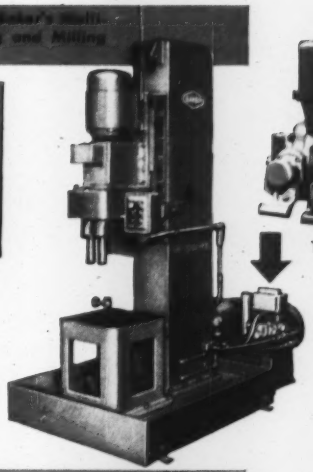
Two Oilgear "JK" Feed Pumps on Baker's Four Station Automatic Transfer Type Machine.



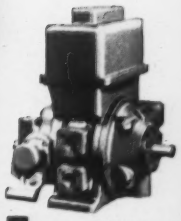
Two Oilgear "JK" Feed Pumps on Baker's Multiple Head Drilling, Boring, Reaming and Milling Machine.



Two Oilgear "JK" Feed Pumps on Baker's Double End Drilling, Boring and Reaming Machine.



Oilgear "JK" Feed Pump on Baker's Double Spindle Vertical Drilling, Boring and Reaming Machine.



Type "JK" Pump Built in four sizes.

HOW CAN YOU USE THESE SIMPLE, VERSATILE, EASILY APPLIED, PROFITABLE UNITS?

Baker Brothers, Inc., pioneers in machine building, users of Oilgear Feed Pumps since 1925, employ Oilgear "JK" Fluid Power Variable Delivery Feed Pumps on a host of machines including the headline-making 100-foot-long transfer machine and their own commercially available portable hydraulic power unit which you can see in photos Nos. 1 and 3 on this page.

The Oilgear "JK" Feed Pump offers many advantages, not the least of which are easy applicability and accessibility. There's no need in many cases for machine redesign and engineering. And this unit does so much to speed cycle time—traverse speed for example can be 265 times feed rate—that production rises dramatically and costs subside. Both coarse and fine feed rates can be varied infinitely so you at once discover the best rates for your work—and the automatic built-in compensator holds the selected fine feed *unvaryingly*. All functions are controlled automatically, semi-automatically or manually.

Evidence of Oilgear "JK" dependability is growing. In one large automotive plant, now 75% changed over to Oilgear, hydraulic maintenance staff was cut from 6 men to one man per shift. In another great automotive plant, the records show Oilgear is found to give the finest service of all.

There's much more to tell especially about two new units added to the "JK" line. Why don't you send for free literature that gives all the facts and figures. So you won't forget, send for it now.

THE OILGEAR COMPANY
1570 W. PIERCE STREET
MILWAUKEE 4, WIS.

OILGEAR
Fluid Power

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS AND VALVES

How to make the most of your engineering career

ONE OF A SERIES

go where an engineer can rise to the top

In many companies, an engineer rises, but soon encounters a low ceiling. Promotions tend to go to non-engineering executives. And engineers (surveys show) find it difficult to make their ideas understood—or appreciated.

So select a company in which you'll be working with, and for, engineers—where an engineer is given an opportunity to advance when positions ahead open up.

Another point: choose a company that's growing, preferably in an *industry* that's growing and expanding too.

Boeing, you'll discover, fills the bill on all counts. Engineers at Boeing hold jobs right to the top. They talk your language. They appreciate the vital contributions engineers make. And they reward *engineers.* Boeing is growing fast, and today employs 400% more engineers than 10 years ago. Besides, Boeing operates in the dynamic, fast-growing field of aviation.

At Boeing you'll enjoy assignments that lead to an excitement-filled future. A future with a *future:* in supersonic flight, jet-powered civil and military aircraft, gas turbine engines, guided missiles. At Boeing, engineers and scientists of *all* types, and advanced mathematicians, are probing the very frontiers of knowledge. They invite you to join them. You'll find high salaries, career stability, retirement programs, and company-financed opportunities for graduate study. And you'll live in wide-awake, young-spirited communities.

Plan ahead for your *career. Fill out the coupon and get it in the mail—today!*

BOEING

An "engineers' company" since 1916

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Co., Dept. F-59, Seattle 24, Wn.

Please send me information about Boeing career opportunities. If a choice is available, I'm particularly interested in openings at:

Seattle Wichita Melbourne, Fla.
(circle one)

Name _____

College (s) _____ Degree (s) ___ Year (s) ___

Address _____

City _____ Zone ___ State _____

Telephone Number _____

ANNOUNCING...

the Beryllium Copper ROLLPIN®

Strong . . . highly resistant to corrosion . . . nonmagnetic . . . extremely conductive

Now you can use Rollpin to cut assembly and maintenance costs in a whole new group of applications. A new line made of beryllium copper, one of the strongest of the copper base alloys, opens the door to a wide variety of uses where resistance to corrosive attack, good electrical properties and other unusual characteristics are required. These slotted tubular copper spring-pins can be used in assemblies that range from plumbing fixtures to electrical instruments, particularly in conjunction with other copper base alloy components.

Rollpin has already established its ability to replace taper pins, straight pins and set screws; to serve as a rivet, dowel, hinge pin, cotter pin or stop pin . . . eliminating special machining, tapping and the need for hole reaming or precision tolerances. Driven into a hole drilled to normal production standards, it locks securely in place, yet can be readily drifted out and reused whenever necessary.

Rollpin is available in beryllium copper from .062″-diameter to .250″-diameter, and in steel and stainless steel up to .500″-diameter.

ELASTIC STOP NUT (ESNA) **CORPORATION OF AMERICA**

Dept. R35-13, Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

☐ Data on beryllium copper Rollpin

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

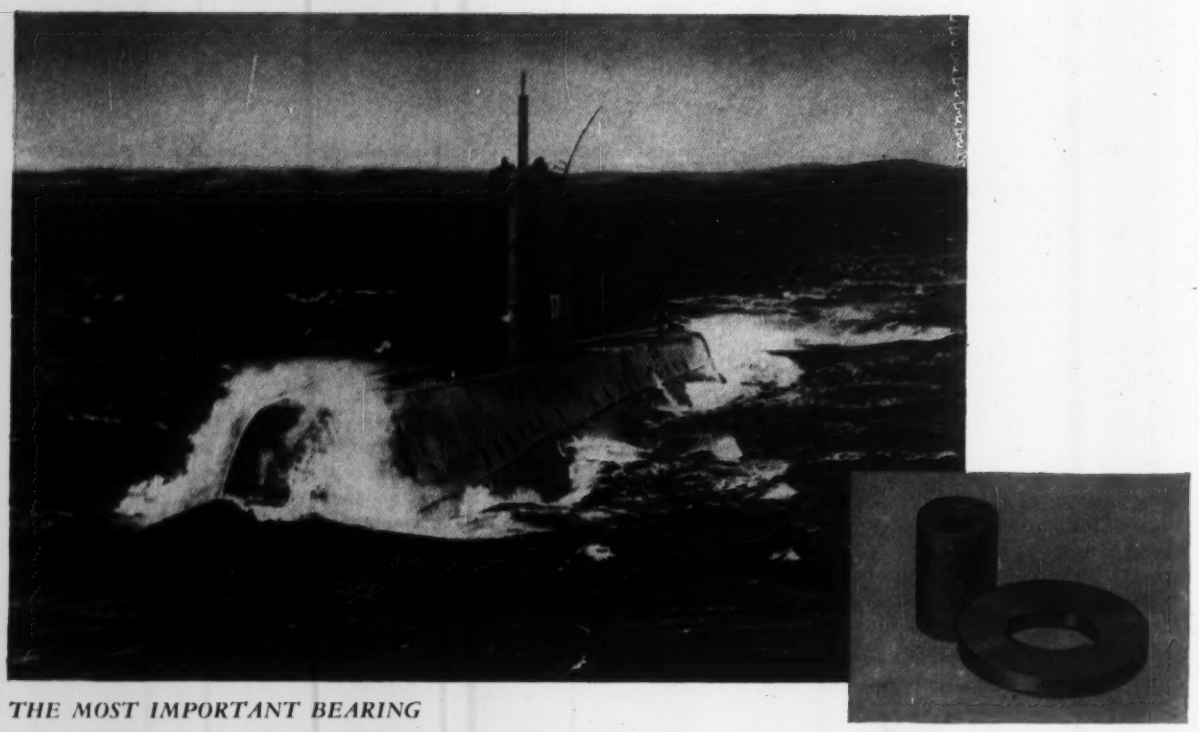
Firm_____

Street_____

City_____ Zone____ State_____

Are your seals or bearings subject to difficult operating conditions?

GRAPHITAR® (Carbon Graphite) has the specific properties needed in difficult applications like these . . .

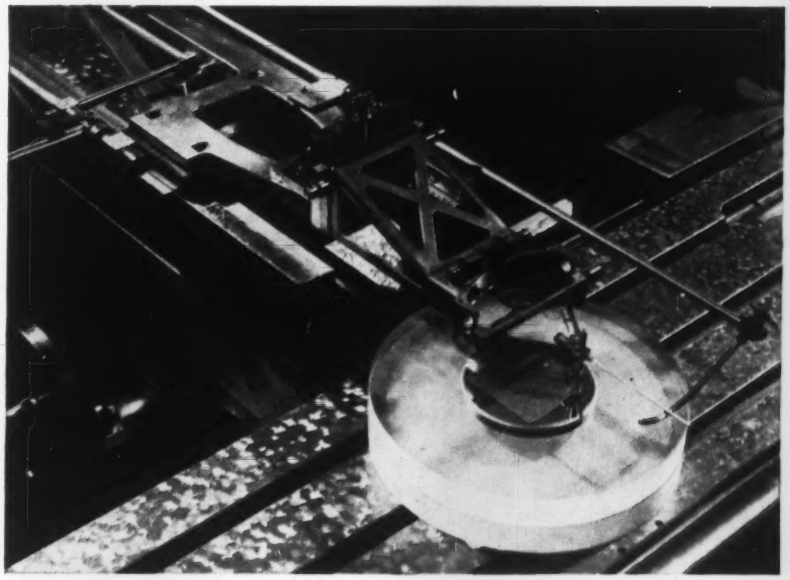


THE MOST IMPORTANT BEARING

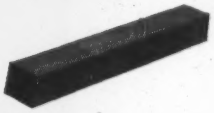
Dependability is vital in the power plant of the Navy's atomic submarine U.S.S. Nautilus which has steamed a total of about 50,000 miles of which approximately half has been submerged. In the reactor cooling system of the submarine, special "canned" motor pumps with integrated pump and drive motor were developed by Westinghouse. The bearings in these pumps, which are made of GRAPHITAR, must withstand high speeds, high temperatures, high pressures and must operate for indefinite periods of time without maintenance and with radioactive water as the only lubricant. Westinghouse Electric Corporation engineers—the builders of the Nautilus' atomic power-plant—find that GRAPHITAR is excellent for this difficult bearing application, because of its strength, durability, self-lubricating properties, and chemical inertness. If your design calls for superior bearings, consider the material that worked on such a demanding job.

THE UNITED STATES

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® SINTERED METAL PARTS • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

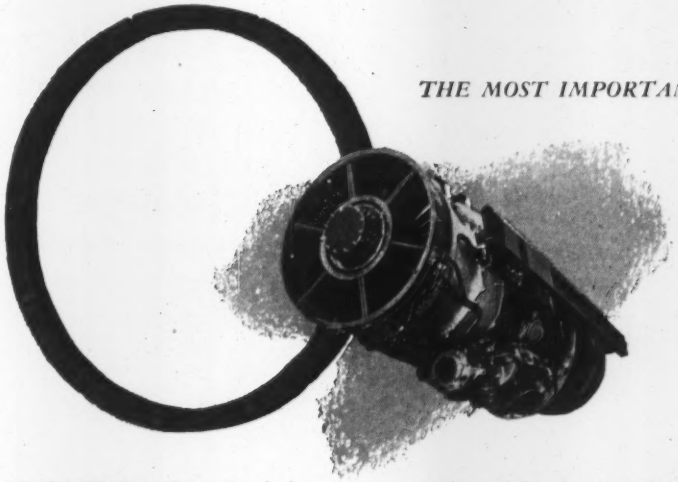


THE MOST EXACTING BEARING



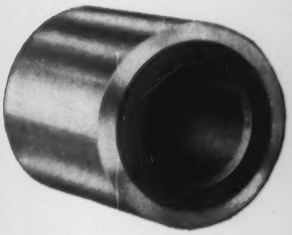
The Bausch & Lomb Optical Co. of Rochester, N.Y., world renowned manufacturer of precision, scientific optical instruments, employs 10 GRAPHITAR bearings in its unique and highly specialized "ruling engine." The GRAPHITAR bearings provide dimensional stability within one-millionth of an inch for micro-inch accuracy in cutting 15,000-30,000 equidistant lines to the inch on 7" aluminized glass blanks to make diffraction gratings used by science and industry for spectroscopic analysis. Bausch & Lomb engineers have found that GRAPHITAR is unsurpassed as a bearing material where very close tolerances must be maintained and where frequent starting and stopping under heavy loads is a problem. These bearings have contributed greatly to the achievement of extreme accuracy in this application. If you require precision performance as was the case with a "ruling engine" why not use GRAPHITAR?

THE MOST IMPORTANT SEAL



GRAPHITAR is the main shaft seal in the Pratt & Whitney J57 turbojet engine which powers many of our new aircraft, including the huge Boeing B-52 Intercontinental Bomber, which has eight of these turbojets. Naturally, the J57 must perform with utter dependability. One of the components of the J57 is the air/oil seal of GRAPHITAR on the turbine main shaft, and this seal is subjected to tremendous shaft speeds, as well as other taxing physical conditions. GRAPHITAR parts can stand severe operation because they are strong and are virtually unaffected by extremes of speed, pressure, and temperature. If your product develops high speeds or other difficult physical stresses on its parts, perhaps GRAPHITAR components could give it more dependable operation.

THE TOUGHEST APPLICATION



Steel mills are famous for the rough, tough, heavy-duty jobs that they perform. In such difficult steel mill applications as bearings for shear and cut-off tables or coil and slab conveyors, metal-backed GRAPHITAR parts provide exceptional strength and durability. GRAPHITAR alone is a very strong bearing material, and when backed with metal has added resistance to shock. Because of its very low coefficient of friction, GRAPHITAR can operate under heavy loads at high speeds with no lubrication. Can the strength and superb bearing qualities of GRAPHITAR simplify your product design?

Get your copy of Engineering Bulletin No. 20.

GRAPHITAR is compacted from carbon-graphite powders under great pressures, then furnaced at heats near 4500°F. It can be formed in relatively complex shapes and ground to tolerances as close as .0005". For more information on this strong, light, self-lubricating engineering material, write for our Engineering Bulletin No. 20.

218

GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

Engineers wanted for this assignment:

DESIGN MISSILES FOR MEN

That is the bold objective of the men who engineered and built the Mustangs, Sabres and Super Sabres. Today their mental altimeters are in the stratosphere... their pulse count in Mach numbers. And the airplanes emerging from this new engineering metabolism are veritable missiles in speed and altitude, yet they must house and protect a human pilot in the midst of otherwise fatal phenomena.

Today's aircraft engineer must overcome an atmosphere that ranges from bone-freezing cold to blood-boiling heat... speeds where shock-wave drag and aerodynamic heating demand a bold new approach in design, materials and production techniques.

He is asked to add strength and power—yet cut weight... solve flutter in theory, *and* with a producible design... provide controls that make his vehicle a stable weapons platform even when flying at supersonic speeds.

Finally, his brainchild must graduate from preliminary design and wind tunnel to prove itself both in the air and on the production line. If *it* fails—*he* has failed.

In this realm of both unknowns and stark reality, engineering is no job for the timid or the easily discouraged or the fellow looking for a soft berth.

A COMPANY WORTHY OF THE GOAL. Engineers have consistently guided the long-range technical advancement of North American Aviation. Newness and progress here are SOP. Some of the longest necks in the industry are on our engineering team. They've been sticking out into the future of aviation for years.

IF YOU'D LIKE TO STICK YOUR NECK OUT... we promise you a management climate that stimulates personal growth—and rewards it with professional and material benefits that are limited only by your own ability.

Write today for full particulars to: Mr. T. J. Wescombe, Engineering Personnel Manager, Dept. 1-ME, North American Aviation, Inc., Los Angeles 45, California.

ADVANCEMENT IS RAPID WHERE GROWTH IS RAPID

In 1943, **AARON KOLOM** graduated from the Illinois Institute of Technology with a B.S.M.E., a scholastic Honor Man in all departments. At North American his first position was in the Structures Section. He was appointed Supervisor of Wing Structures in 1951. With the help of North American's Educational Refund Plan, he received his M.S.A.E. in 1952. And last March, Aaron was promoted to Assistant Project Engineer.

BILL McLEAN obtained his Bachelor of Science degree in Electrical Engineering at Wayne University in 1950. He received his Master's Degree at the University of Southern California in 1951. He began his engineering career at North American Aviation as a Research Analyst in the Servomechanisms Group. Now, five promotions later, Bill is a Group Leader in charge of the Systems Simulation Section.

NORTH AMERICAN AVIATION, INC.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

It costs you nothing to prove

CLEARPRINT
IS AMERICA'S FINEST TECHNICAL PAPER

YOU BE THE JUDGE . . .

Ask for sample sheets to make the famous Clearprint test. With this convincing two-minute trial you will see for yourself why leading engineers, architects and designers from coast-to-coast insist upon Clearprint for their original drawings and permanent records.

Make this famous CLEARPRINT TEST

1. **INVITES PENCIL AND PEN** — Try Clearprint's perfect working surface with a 2H pencil, then with a ruling pen. Lines are sharp and clean — no feathery edges.
2. **NO GHOSTING** — Erase some of the lines. Redraw and erase several of them repeatedly. Crease the paper, too. Then hold it to the light, or make a reproduction. Seeing is believing!
3. **NEVER CHANGES** — Sheets in use since 1932 prove Clearprint's remarkable stability. Its strength, transparency and printing qualities remain unchanged after extended exposure to age, atmosphere, heat and light.

Make this test, too, on the paper you are now using. The difference will convince you!

THERE'S A CLEARPRINT PAPER FOR EVERY JOB

Tracing Paper "Papercloth"
Clearprint Charts
Federal Aid Sheets • "Fade-Out" Grid Paper

IN SHEETS, PADS and ROLLS

CLEARPRINT®

TECHNICAL PAPER

THERE IS NO SUBSTITUTE — Demand Watermarked Clearprint

2

SEEING is BELIEVING!

Ask your dealer for samples, or send coupon-

CLEARPRINT PAPER CO. ME
1482 - 67th St., Emeryville, Calif.

☐ Please send me Clearprint Paper samples, with prices, for the following uses:_____

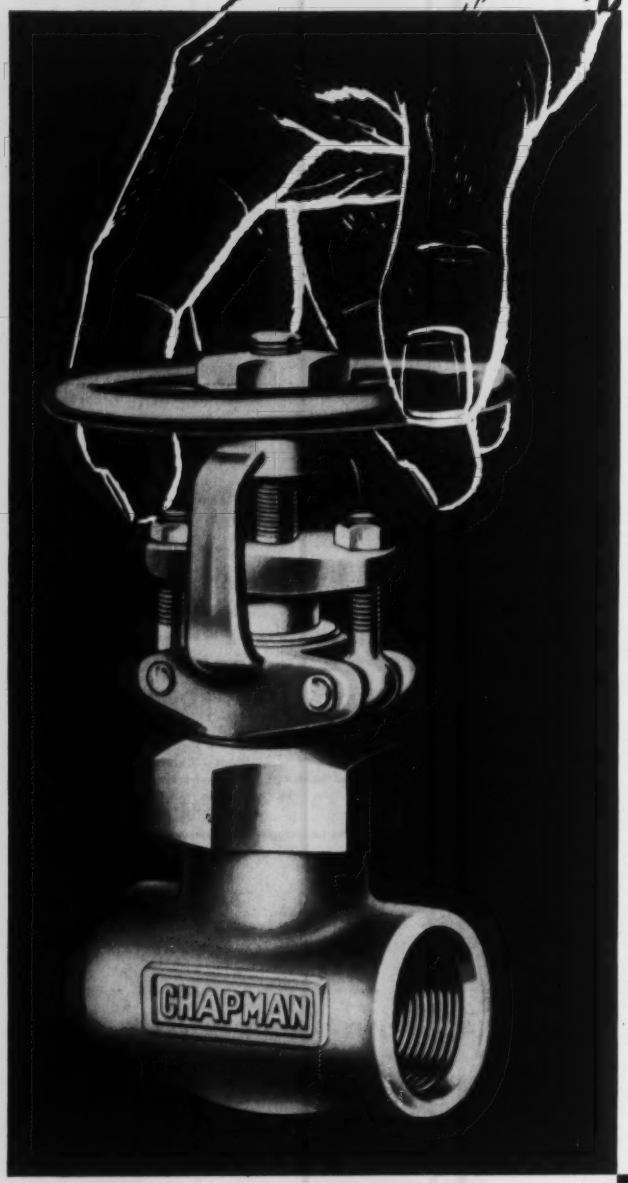
_____

☐ Have your representative call at my office

Name_____
Firm_____
Address_____
City_____ Zone____ State_____

Clearprint Paper is WATERMARKED for your protection.

TURN ON PERFORMANCE
...Turn off your Costs!



CHAPMAN LIST 960
Forged Steel Gate Valves

This is an open and shut case of top performance and lowest maintenance. To begin with, the wedge faces on Chapman List 960 are *super* hard. In fact, they're hardened to 800 Brinell by Chapman's *exclusive Malcomizing process.* They can't seize. They can't gall. The seat rings are hardened stainless steel. They last longer and, when necessary, they're very easy to replace.

There are no full-pressure repacking difficulties. Bolted follower on the outside screw rising stem design has no threads that are exposed.

Is it any wonder there are more Chapman List 960 valves on more jobs than any other small forged steel gate valve? They stand up perfectly under conditions ranging from 380 psi at 1000°F to 2000 psi at 100°F. You use Chapman List 990 valves for higher pressures. Sizes for List 960 are from ¼" to 2". You can have rising stem with yoke or rising stem with inside screw. And the Bonnet joint is either gasketed or ground metal-to-metal, depending upon your needs.

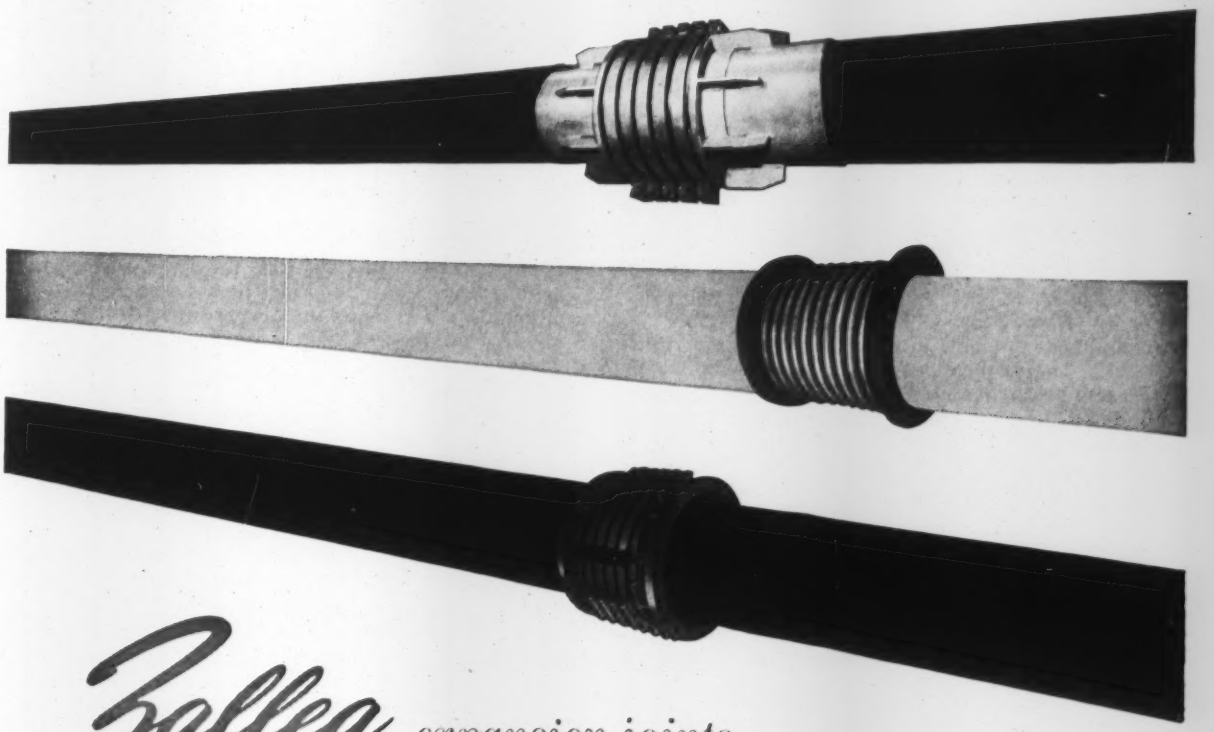
To take a good look at the ways to cut your valve costs, take a good look at our Catalog 10. Write, today, for your copy.

The CHAPMAN VALVE MANUFACTURING CO.
INDIAN ORCHARD, MASS.

The true cost of an expansion joint is not the figure on the manufacturer's price tag. Many factors enter into any such cost determination. For example, an expansion joint that fails just when it shouldn't could wreck a plant and cost a small fortune. And, assuming equal first-cost of any two competitive manufacturers' designs, one that stands up twice as long as the other . . . costs only half as much on a unit-time basis. So, one really shouldn't count on "price" as a measure of value.

But here is one thing you can count on. Every single expansion joint in the Zallea line is designed and built to assure maximum reliability —and top value for your dollar. This is no empty boast, but a fact that can be confirmed for you by figures.

Zallea representatives are always ready to help solve problems relating to expansion joints. Or if you prefer, write today on your company letterhead for your copy of Catalog 56, our newly published 72-page comprehensive expansion joint manual.

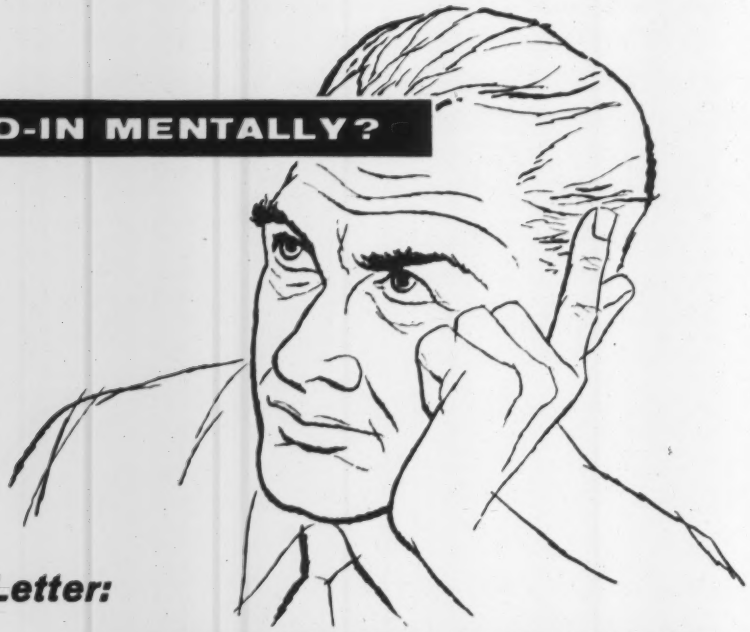


Zallea *expansion joints*

ZALLEA BROTHERS, 820 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

BOXED-IN MENTALLY?



An Open Letter:

TO ENGINEERS, SCIENTISTS AND MATHEMATICIANS

Who Are Thinking of the Future

Whatever Your Past Experience... There's a Place for You in Atomic Energy at B&W

Take stock of yourself . . . your job . . . your living conditions. If you're boxed-in mentally; if your future looks dim; if you're living somewhere west of nowhere, or in a crowded city—or an outlying suburb—now is your chance to get out and better yourself. Get in atomic energy. Enjoy an interesting job and live in Lynchburg—the heart of Virginia's Blue Ridge country.

There's plenty of elbow room right now in atomic energy at B&W. There's plenty of room to grow, as so many of our men have discovered. This is the place and the field to consider, if—like most men with your education and background—you're thinking about your future.

HERE IS A NEW FRONTIER—for you at B&W. And you don't need specific nuclear experience to take advantage of the opportunities. If you have training or experience in any of the following fields, there's a job waiting for you at B&W in which you can fruitfully apply your talents.

Mechanical Engineering • Physics • Chemistry • Mathematics Civil Engineering • Chemical Engineering • Electrical Engineering • Engineering Physics • Fuel Technology • Metallurgy • Metallurgical Engineering • Nuclear Engineering

THERE'S AN EXTRA PLUS, TOO. Fine living conditions in a clean city with excellent schools—and the friendliest sort of people for neighbors.

B&W's engineering research and development background spans nearly 100 years. We've been active in atomic energy from the beginning — at Oak Ridge, Los Alamos and Hanford. We're working today on a variety of projects—designing and building the first privately owned nuclear power plant, pioneering in research reactors at home and abroad, developing a pressurized-water reactor for the first nuclear-propelled cargo vessel.

Atomic energy is in its infancy. The opportunities for personal and professional recognition are great. You can become part of the group of engineers, scientists, and mathematicians who truly are writing the rules, paving the way for those who come after you in this great field. It's like being at Kitty Hawk with the Wright Brothers. You're on the ground floor with B&W and you can grow with the field.

TODAY is the day to take that step toward building your future. If you like new and different problems, we have the job for you. The Babcock & Wilcox Company, Atomic Energy Division, 161 East 42nd Street, New York 17, N. Y.

PE-19-AE

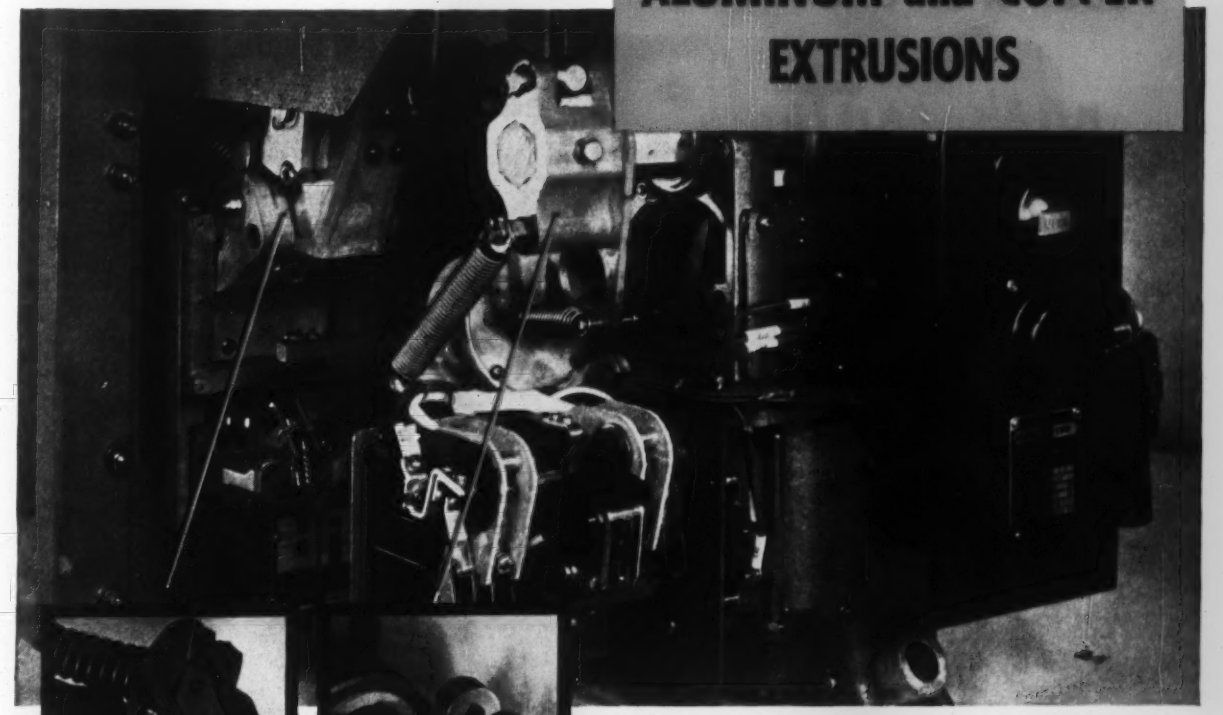
Write for literature describing some of B&W's atomic energy activities or send resume to: Personnel Department, ME-1, The Babcock & Wilcox Company, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

ATOMIC ENERGY DIVISION

REVERE
ALUMINUM and COPPER EXTRUSIONS

I-T-E CIRCUIT BREAKER—KD (3,000 amp. rating) showing progressive assembly with Revere Copper and Aluminum Extrusions in place. I-T-E Circuit Breaker—KE is same type with 4,000 amp. rating.



COPPER
for conductivity

ALUMINUM
for economy

—form a Money-Saving team in latest

I-T-E CIRCUIT BREAKERS

Revere T. A. Service an Important Factor in Ultimate Design of Parts

The larger of the two extruded and drawn copper shapes shown at extreme left started out on the drawing board as two pieces. It was thought that a single shape of this size could not be made satisfactorily. At this point, I-T-E Engineers got together with Revere's T. A. (Technical Advisory) Service and threshed things over. The final result is the one-piece extrusion shown and a reduction in machining time.

Aluminum was selected for the other extrusion shown because I-T-E found that it cost less per pound of metal and had a higher strength ratio when compared to a casting. Also, space was a factor. In all, Revere supplies 5 copper and 2 aluminum extrusions for KD and KE type I-T-E Circuit Breakers. All were designed to fit specific requirements of I-T-E Engineers. Where it could be used satisfactorily, aluminum was applied because of economy, while current carrying members called for copper.

This is still another example of Revere supplying the metal that will do the best job and with the greatest economy . . . be it aluminum, copper or any one of their alloys. So, with new things happening all the time in non-ferrous metals it can pay you to keep in close touch with Revere.

COPPER ★ BRASS ★ 18 01 ★ REVERE ★ ALUMINUM

REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago; Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

FLUSH WITH OZONE FOR

odor control

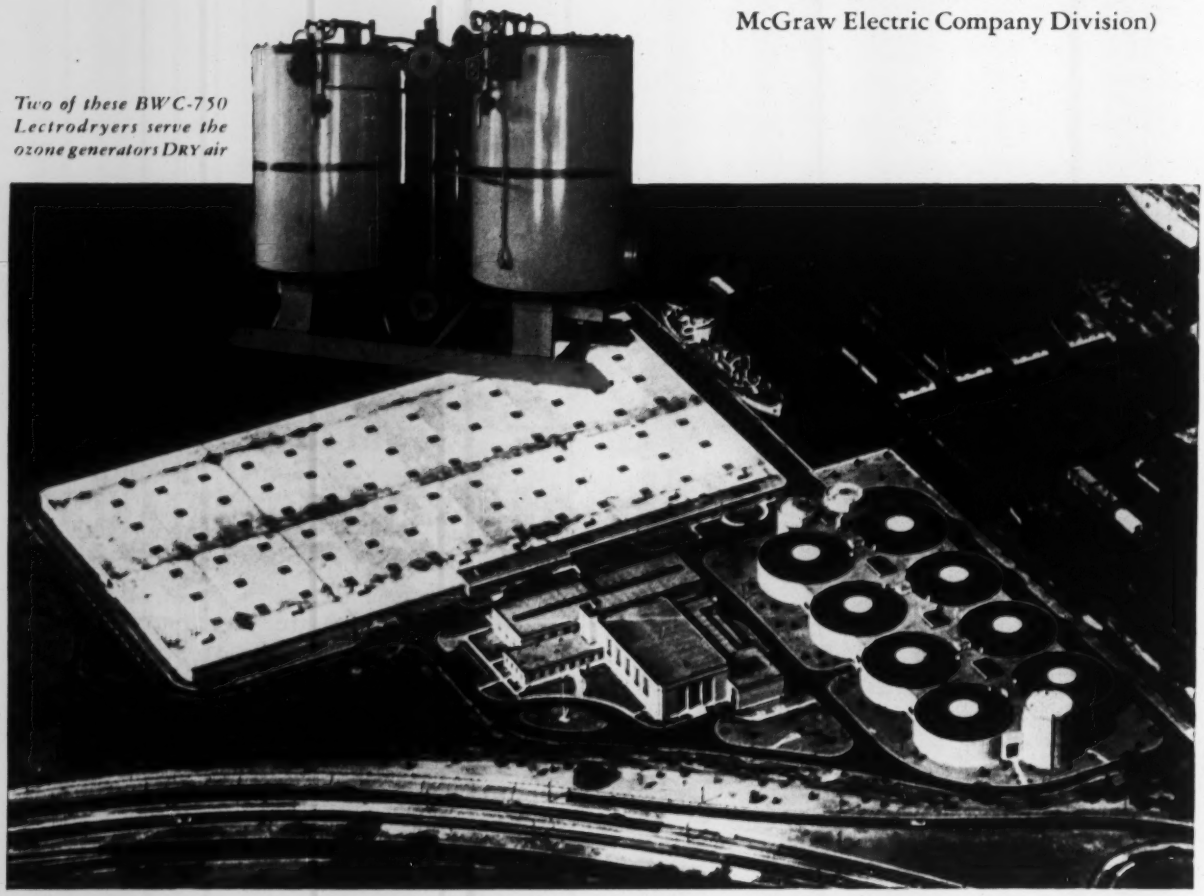
OZONE GENERATORS ARE FED DRY AIR BY LECTRODRYERS*

NO ODORS! To meet this mandate, all tanks were covered. Air from the rooms is passed through a huge chamber and mixed with ozone. Thus odors are killed at the source.

DRY air is fed to the ozone generators by Lectrodryers to keep them operating at top efficiency—another Lectrodryer contribution to industry.

Are you troubled with moisture? We'll send data telling how others have stopped it. Write Pittsburgh Lectrodryer Company, 335 32nd St., Pittsburgh 30, Pennsylvania. (a McGraw Electric Company Division)

Two of these BWC-750 Lectrodryers serve the ozone generators DRY air

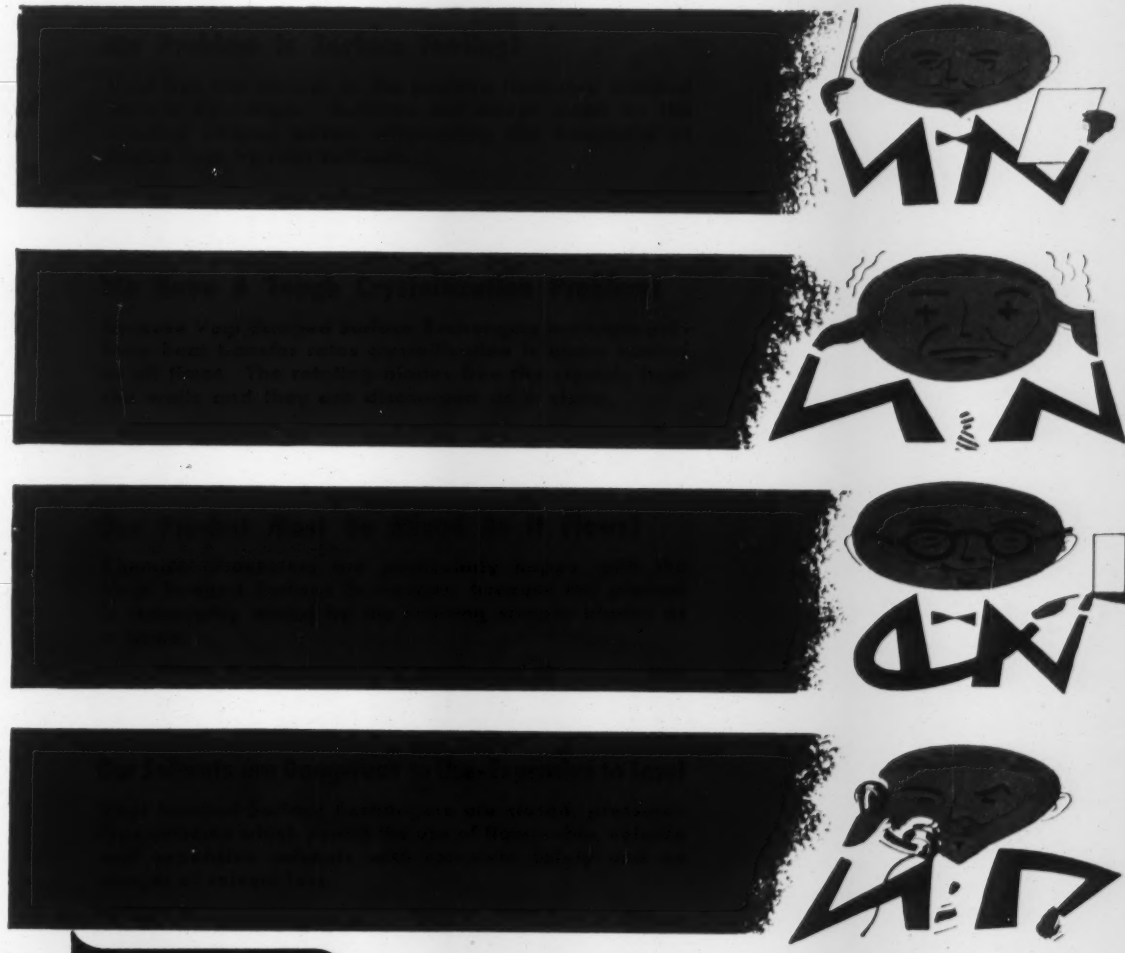


Owl's Head Sewage Treatment Plant constructed under supervision of Mr. Frederick H. Zurmuhlen, P.E., R.A., Commissioner of Public Works, City of New York.

Lectrodryer

*REGISTERED TRADEMARK U. S. PAT. OFF.

Have You a Special Heat Transfer or Chiller Problem?



Vogt

Has the answer in its

Scraped Surface Exchangers

Send for Bulletin PE-1 today.
Address Dept. 24A-RIM

OTHER VOGT PRODUCTS: Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making and Refrigerating Equipment.

HENRY VOGT MACHINE CO., P. O. BOX 1918, LOUISVILLE 1, KY.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati, San Francisco

ENGINEERS...

Help develop the world's first nuclear powered fleet

Nuclear power offers tremendous advantage for naval vessels. From the fuel standpoint, cruising ranges are virtually unlimited—even at new high speeds. No refueling facilities will be required to replenish nuclear propulsion fuel. Therefore, the physical design of the fleet can be streamlined for greater efficiency and safety.

At the country's largest design-engineering center for nuclear power reactors, Bettis Plant in Pittsburgh, operated for the Atomic Energy Commission by Westinghouse, the application of nuclear power has progressed rapidly. However, the nuclear power plants already in operation today represent only the beginning of a new technological era. *Major advances in many areas are necessary.*

The complexities of handling nuclear materials and controlling the reactor have opened up a whole new field in mechanism design. Atomic power plant equipment requires engineers who are capable of developing the unique valves and pumps that are required in the primary system of a pressurized water reactor. In addition, boilers, heat exchangers, steam generators and other plant equipment require special design and development work.

To do this, Bettis Plant needs farsighted men. Regardless of your interest, you can choose a place in the varied operations at Bettis Plant.

Atomic experience is not necessary.

What's more, Bettis Plant is in Pittsburgh's South Hills. Here you can enjoy good living in pleasant suburbs near the plant, and still be convenient to one of the nation's most progressive metropolitan areas.

Educational opportunities are exceptional. Westinghouse helps you continue your studies at any one of three Pittsburgh universities.

Write for descriptive brochure on opportunities in your field. Be sure to specify your interests. Address Mr. A. M. Johnston, Westinghouse Bettis Plant, Dept. A81, P.O. Box 1468, Pittsburgh 30, Pa.

BETTIS PLANT

Westinghouse

Your Company Got the BENDS?

If you've got the bends... pipe bends, that is... stop and think a moment about this: ADSCO Expansion Joints will do a better job because of...

- ***LESS HEAT LOSS.*** A 12-inch line 1000 feet long, carrying steam at 200 lbs. and 550 F. will lose 16% more heat if bends are used instead of ADSCO Expansion Joints.
- ***LESS PRESSURE DROP.*** The same line will have a 28% greater pressure drop with bends than with ADSCO Expansion Joints.
- ***LESS SPACE.*** One pipe bend requires 50 or 100 cubic feet of valuable space. ADSCO Expansion Joints require no extra space.
- ***LOWER COST.*** Used to absorb 4 inches of expansion per 150 feet of 12-inch pipe, an expansion bend, or loop, will cost 50% to 100% more than an ADSCO Expansion Joint. Similar savings will result from the use of ADSCO Expansion Joints in other sizes of pipe lines.

If you are planning construction of a pipe line or modernization of an existing one with bends, ADSCO invites inquiries on the use of Corruflex Packless or Slip-type Expansion Joints.

Write for Bulletins 54-10PR and 35-51-PR.

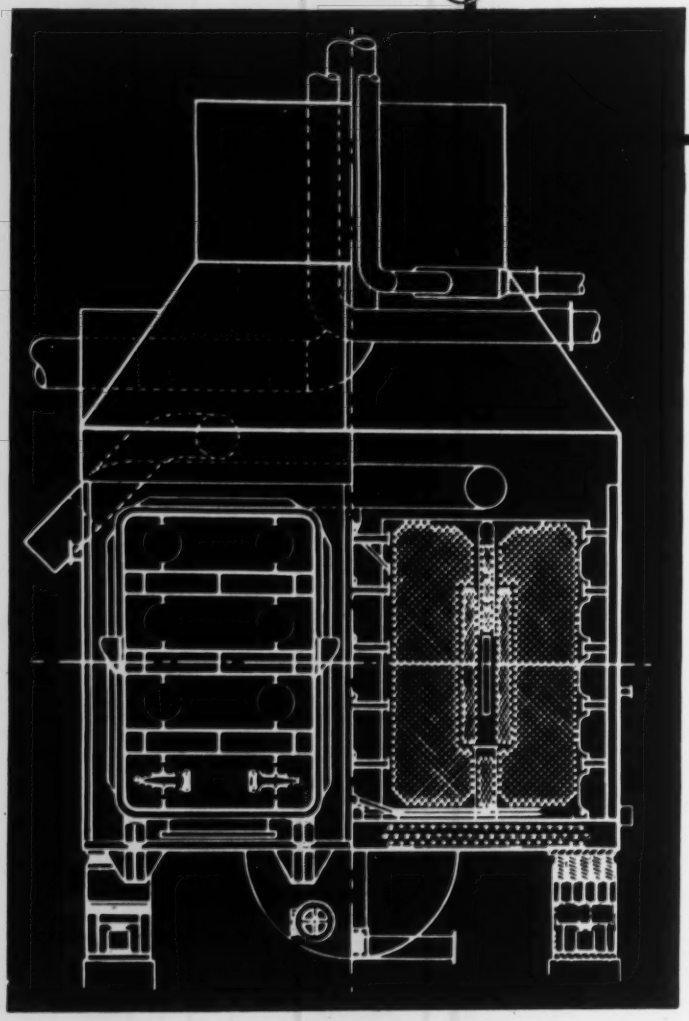
AMERICAN DISTRICT STEAM DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

ADSCO
ENGINEERED PRODUCTS

DUAL BANK Condensers

by C. H. Wheeler

For Your Electric Generating Plants of Tomorrow



- Specifically designed for larger, more efficient electric generating stations.
- Adaptable to your station layout.
- Designed to minimize field erection problems.
- Additional steam lanes shorten path and resistance to steam travel.
- Lower pressure drop and higher vacuum.
- "Zero" condensate temperature depression.
- DEAERATION . . . 0.01 cc per liter is attainable.
- Purity of condensate.

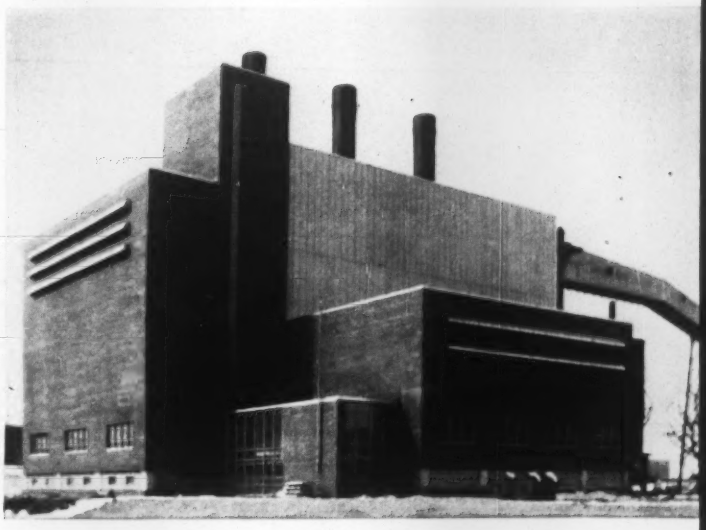
At C. H. Wheeler the most modern engineering techniques are at your service. Let our engineers help you. Contact your local representative or

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PA.

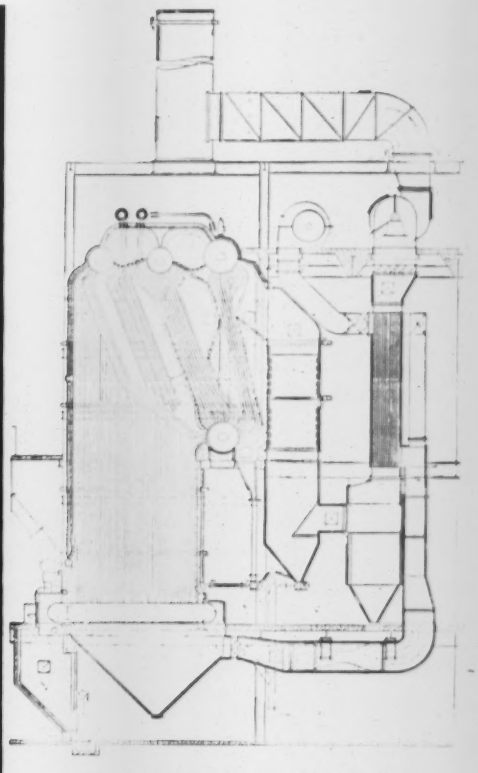
Manufacturers also of Vacuum Equipment • Pumps for Circulating Water, Condensate, Water Supply and Drainage
Marine Auxiliary Machinery • Special Products for Atomic Service

WE 607

C.H. Wheeler OF PHILADELPHIA



Power Plant, Milwaukee County Institutions



Longitudinal Section of Union Type B Boiler

Union Boiler Trio scores 86.52% in efficiency test at Milwaukee County Institutions

Grouped on a 1200-acre tract, Milwaukee County Institutions have the self-sufficiency of a small community. With 4 hospitals, a sanitarium, children's home, administration building and nurses' home, this health and child-care center has its own fire department, bakery, laundry, garage and power plant. In all, there are 35,000,000 cu. ft. of buildings providing complete facilities for 6000 patients and 3100 employees.

Three Union 4-drum, Type B Boilers handle the entire steam demand for space heat and electrical power. Each has a continuous capacity of 110,000 lbs./hr. at 625 psig and 745° F. *The institutions have no other source of heat or power!*

Job-tested at an average individual output of 110,934 lbs./hr., this Union boiler team has topped performance guarantees with an 86.52% efficiency rating. *Economy of operation has been clearly substantiated!*

This is one of many installations supplying "proof-through-use" evidence of Union efficiency and dependability. Serving industrial, institutional and public power plants, Union Boilers are widely known for their ability to measure fully up to expectations.

GET FULL DETAILS

Make sure that you are acquainted with the several types of steam generators built by Union by writing for illustrated Catalog GB-153.

UNION

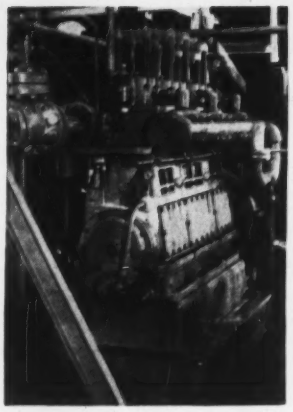
UNION IRON WORKS
ERIE, PENNSYLVANIA

"It'll pay us to replace it with an ALDRICH PUMP!"

Downtime, due to pump failure, is always a costly item. It takes the reliability and freedom from maintenance found in an Aldrich Pump to assure 100% availability of hydraulic power.

The very simplicity of the Aldrich Direct Flow design means horizontal straight line flow from suction to discharge. Reduced space between valves results in higher volumetric efficiency. Fluid-end sectionalization for fast, easy maintenance; changeable plunger sizes; and interchangeability of parts are additional reasons why Aldrich Pumps have earned a reputation for dependable, low cost performance on applications such as die casting, hydraulic press operation, roll balancing, descaling and hydraulic testing.

For your tough pumping problems, it pays to specify Aldrich. Write today for a copy of Data Sheet 100, a condensed catalog and selection chart covering our entire line. The Aldrich Pump Company, 29 Pine Street, Allentown, Pa.



Four 5" stroke Aldrich Direct Flow Pumps on die casting service in a midwestern metalworking plant. These pumps are handling 250 gpm at 1500 psi.

THE ALDRICH PUMP COMPANY

Formica IMPROVED FABRICATED PART . . . SAVED CUSTOMER 23%!

Formica studied performance requirements, developed a special grade, produced a better part, and saved the customer 52c a pound.

Are you buying laminated plastic properties you don't need? Or are you paying the penalty of poor product performance because you've been short-changed on essential properties?

You can never be sure until you have a Formica fabricating engineer check your performance requirements. Tell him what you need, where and how you'll be using your fabricated part. Then he'll select the *one grade* that's best and most economical for you.

With 52 standard grades, and a competent research staff to develop special new ones, there's never any compromise with grade selection at Formica. And design modifications recommended by Formica fabricating engineers will further help to produce a better part, frequently at big savings.

Fabricating is part of Formica-4, the complete laminated plastics service that assures you better fabricated parts — often for less money. To learn how, send for your free copy of the new folder described below. Formica Corporation, subsidiary of American Cyanamid, 4540-7 Spring Grove Ave., Cincinnati 32, Ohio.

FORMICA CORPORATION

Please send me at once "Better Laminated Plastics Parts" folder which shows how Formica improves fabricated parts frequently at big savings.

Name_____

Company_____

Street_____

City_____ Zone____ State_____

First choice in laminated plastics: Application Engineering • Research • Fabricating • Customer Stock Service

Where to look for these 1954-1955 Technical Papers

NO reprints of the papers are available but the issues of the magazines in which they are published can be supplied at $1.50 a copy for the ASME TRANSACTIONS ($1.00 each to ASME members) and at 75¢ a copy for MECHANICAL ENGINEERING (50¢ each to ASME members).

HYDRAULIC

May 1955 Transactions
The San Bartolo Vertical Impulse Turbine, by Javier Fuentes, Salvador Almanza, and W. J. Rheingans.
Mechanism of Cavitation Inception and the Related Scale-Effects Problem, by R. W. Kermeen, J. T. McGraw, and B. R. Parkin.

Nov. 1955 Transactions
Through-Flow in Concentric and Eccentric Annuli of Fine Clearances With and Without Relative Motion of the Boundaries, by L. N. Tao and W. F. Donovan.
A Theory of the Fluid-Dynamic Mechanism of Regenerative Pumps, by W. A. Wilson, M. A. Santalo, and J. A. Oelrich.

Jan. 1956 Transactions
Water Tunnels for Hydraulic Investigations, by J. M. Robertson.
An Extension of the Theory of Water Hammer, by R. Skalak.
Design of Optimum Clearances in Positive-Displacement Pumps and Motors, by W. E. Wilson.

Feb. 1956 Transactions
Performance Characteristics of Francis Type Pump-Turbines, by W. J. McCormack.

July 1956 Transactions
An Experimental and Analytical Investigation of a Differential Surge-Tank Installation, by W. L. Gibson and W. Shelson.
A Comparison of Regenerative-Pump Theories Supported by New Performance Data, by Yasutoshi Senoo.
Hydraulic-Turbine Runner Vibration, by R. M. Donaldson.

Aug. 1956 Transactions
Water-Column Separation in Pump Discharge Lines, by R. T. Richards.
Hydraulic Transients in Centrifugal Pump Systems, by C. P. Kittredge.
Surge-Wave Velocity—Concrete Pressure Pipe, by H. F. Kennison.
Water-Hammer Calculations and Test Results—Owens Gorge Power Plant Penstocks, by A. E. Brathsch and K. O. Cartwright.

Nov. 1956 Transactions
Closed Systems for Testing Compressors, by R. M. Johnson.
The Slotted-Blade Axial-Flow Blower, by H. E. Sheets.
Thermodynamic Aspects of Cavitation in Centrifugal Pumps, by H. A. Stahl and A. J. Stepanoff.
Turbulence and Boundary-Layer Effects on Cavitation Inception From Gas Nuclei, by J. W. Daily and V. E. Johnson, Jr.
Critical Considerations on Cavitation Limits of Centrifugal and Axial-Flow Pumps, by G. F. Wislicenus.
Some Aspects of High-Suction Specific-Speed Pump Inducers, by C. C. Ross and Gordon Banerian.
The Design of Axial-Flow Pumps, by R. D. Bowerman.
Suppression of Pump Vibrations Set Up at Starting Up—Preopening Method, by F. Numachi.

Feb. 1955 Mechanical Engineering
Modern Trends in the Design of Hydraulic-Turbine Governors, by B. R. Nichols.

June 1955 Mechanical Engineering
Design and Operation of Small Canned Motor Pumps, by A. J. Mei.

Aug. 1955 Mechanical Engineering
Design Features of the Flatiron Power and Pumping Plant, by John Parmakian.

INSTRUMENTS AND REGULATORS

May 1955 Transactions
The Dynamics of Filled Temperature-Measuring Systems, by Otto Muller-Girard.

Nov. 1955 Transactions
Predictor Control Optimalizes Control System Performance, by L. M. Silva.

Jan. 1956 Transactions
The Integration of Concepts in the Terminology of Measurement and Control, by H. L. Mason.
Fundamentals of the Vibratory Rate Gyro, by J. B. Chatterton.
Disturbance-Response Feedback—A New Control Concept, by J. B. Reswick.
Evaluation of the Nonlinear Kinetic Behavior of a Nuclear Power Reactor, by R. C. Howard.

Feb. 1956 Transactions
Study of Pneumatic Processes in the Continuous Control of Motion With Compressed Air—I, by J. L. Shearer.
Study of Pneumatic Processes in the Continuous Control of Motion With Compressed Air—II, by J. L. Shearer.
Dynamic Analysis of Chemical Processes, by E. G. Holzmann.

Feb 1956 Transactions (contd)
Determination of System Characteristics From Normal Operating Records, by T. P. Goodman and J. B. Reswick.

May 1956 Transactions
A New Method of Evaluating Dynamic Response of Counterflow and Parallel-Flow Heat Exchangers, by H. M. Paynter and Yasundo Takahashi.
The Dynamic Response of Industrial Thermometers in Wells, by T. C. Linahan.

Aug. 1956 Transactions
Design Basis for Multiloop Positional Servomechanisms, by Sidney Lees.
Control-Valve Plug Design, by J. A. Wiedmann and W. J. Rowan.

LUBRICATION: BEARINGS

Nov. 1955 Transactions
The Short-Bearing Approximation for Plain Journal Bearings, by G. B. DuBois and F. W. Ocvirk.
Studies in Lubrication—X, by M. J. Jacobson, A. Charnes, and E. Saibel.
On the Solution of the Reynolds Equation for Slider-Bearing Lubrication—IX, by F. Osterle, A. Charnes, and E. Saibel.

Jan. 1956 Transactions
Turbulence in a Tilting-Pad Thrust Bearing, by Stanley Abramovitz.
Investigation of Translatory Fluid Whirl in Vertical Machines, by G. F. Boeker and B. Sternlicht.
Oil-Film Whirl—An Investigation of Disturbances Due to Oil Films in Journal Bearings, by B. L. Newkirk and J. F. Lewis.
Load Capacity and Time Relations for Squeeze Films, by F. R. Archibald.

Apr. 1956 Transactions
Journal-Bearing Performance for Combinations of Steady, Fundamental, and Low-Amplitude Harmonic Components of Load, by G. S. A. Shawki.
Analytical Study of Journal-Bearing Performance Under Variable Loads, by G. S. A. Shawki.
Studies in Lubrication—XI, by A. S. C. Ying, A. Charnes, and E. Saibel.
Journal-Bearing Operation at Superlaminar Speeds, by M. I. Smith and D. D. Fuller.

July 1956 Transactions
Behavior of Air in the Hydrostatic Lubrication of Loaded Spherical Bearings, by T. L. Corey, C. M. Tyler, Jr., H. H. Rowand, Jr., and E. M. Kipp.
Power Loss in Elliptical and Three-Lobe Bearings, by Oscar Pinkus.
Prediction of Lubricating-Oil Viscosities at High Pressures, by O. H. Clark.
Density-Temperature-Pressure Relations for Liquid Lubricants, by H. A. Hartung.
Finite Journal Bearings With Arbitrary Position of Source, by J. V. Fedor.
Very Short Journal Bearing Hydrodynamic Performance Under Conditions Approaching Marginal Lubrication, by L. F. Kreisle.
Analysis of Elliptical Bearings, by Oscar Pinkus.
Experimental Investigation of Resonant Whip, by O. Pinkus.
Varieties of Shaft Disturbances Due to Fluid Films in Journal Bearings, by B. L. Newkirk.
Effect of Combustion-Resistant Hydraulic Fluids on Ball-Bearing Fatigue Life, by H. V. Cordiano, E. P. Cochran, Jr., and R. J. Wolfe.
Operating Characteristics of High-Speed Ball Bearings at High Oil-Flow Rates, by C. C. Moore and F. C. Jones.

Aug. 1956 Transactions
Preliminary Investigation of Minimum Oil-Feed Rates for Fluid-Film Conditions in Journal Bearings, by D. D. Fuller and Beno Sternlicht.

June 1956 Mechanical Engineering
Friction in a Close-Contact System, by Walter Claypoole.

MACHINE DESIGN

July 1955 Transactions
Safe Stress Range for Deformation Due to Fatigue, by M. Kawamoto and K. Nishioka.
Dynamic Loads on Spur and Helical-Gear Teeth, by J. B. Reswick.

Aug. 1955 Transactions
Approximate Synthesis of Four-Bar Linkages, by Ferdinand Freudenstein.
The Influence of Tap-Drill Size and Length of Engagement Upon the Strength of Tapped Holes, by C. J. Oxford, Jr., and J. A. Cook.
The Design of the Expanding-Shoe Friction Clutch, by M. J. Cohen.
A Theory of Fatigue-Damage Accumulation in Steel, by D. L. Henry.

May 1956 Transactions
Flow of a Compressible Fluid in a Thin Passage, by S. K. Grinnell.
The Effect of Oil-Column Acoustic Resonance on Hydraulic Valve "Squeal," by F. W. Ainsworth.

May 1956 Transactions (contd)
On the Maximum and Minimum Velocities and the Accelerations in Four-Link Mechanisms, by F. Freudenstein.
Long-Shoe Block Brake With Floating Anchor, by M. F. Spotts.
Determination of Radius of Curvature for Radial and Swinging-Follower Cam Systems, by M. Kloomok and K. V. Muffley.
Determination of Pressure Angles for Swinging-Follower Cam Systems, by M. Kloomok and K. V. Muffley.

July 1954 Mechanical Engineering
The Role of Shock-Testing Machines in Design, by C. E. Crede.

Sept. 1954 Mechanical Engineering
Manufacturing Methods of Power-Transmission Gears and Their Influence on Design Considerations, by D. W. Botstiber.

METALS ENGINEERING

July 1955 Transactions
Carbon-Molybdenum Steel Steam Pipe After 100,000 Hours of Service, by R. J. Sinnott, L. A. Kohrig, J. W. Freeman, and A. I. Kush.

Jan 1956 Transactions
Studies in Cold Drawing—Part 3, Determination of Friction Coefficient, by H. Majors, Jr.
Ultrasonic Testing of Small-Diameter Tubing With Automatic Recording Equipment, by W. L. Fleischmann and H. A. F. Kocha.

Feb. 1956 Transactions
Investigations Into Blade-Root Fixings of High-Temperature Steels, by W. Siegfried.
Factors Influencing the Notch Fatigue Strengthening of N-155 Alloy at Elevated Temperatures, by Walter S. Hyler and Ward F. Simmons.
Factors Influencing the Notch-Rupture Strength of Heat-Resistant Alloys at Elevated Temperatures, by K. L. Carlson, K. J. MacDonald, and Ward F. Simmons.
Zirconium-Fabrication Techniques and Alloy Development, by C. E. Lacy and J. H. Keeler.

Apr. 1956 Transactions
Biaxial Plastic Stress-Strain Relations of a Mild Steel for Variable Stress Ratios, by Joseph Marin and L. W. Hu.
A Method of Predicting the Effects of Notches in Uniaxial Fatigue, by W. E. Dirkes.
The Stress-Rupture Strength of Type 347 Stainless Steel Under Cyclic Temperature, by E. E. Baldwin.
Design Aspects of High-Temperature Fatigue With Particular Reference to Thermal Stresses, by L. F. Coffin, Jr.
Quantitative Evaluation of Thermal-Shock Resistance, by S. S. Manson and R. W. Smith.
Approximate Solution to Thermal-Shock Problems in Plates, Hollow Spheres, and Cylinders With Heat Transfer at Two Surfaces, by A. Mendelson and S. S. Manson.

May 1956 Transactions
The Relation Between Grinding Conditions and Thermal Damage in the Workpiece, by R. S. Hahn.
Measuring the Thermal Diffusivity of Metals at Elevated Temperatures, by M. A. El-Hifni and B. T. Chao.
On the Relations Between Various Laboratory Fracture Tests, by E. M. Lape and J. D. Lubahn.

June 1955 Mechanical Engineering
Evaluating Basic Materials for Nuclear-Fueled Power Plants, by D. O. Leeser.

July 1955 Mechanical Engineering
Ultrasonic Attenuation Measurements for Study of the Engineering Properties of Materials, by R. Truell.

Aug. 1955 Mechanical Engineering
The Role of Powder Metallurgy in the Design of Nuclear-Power Reactors, by H. H. Hausner and M. C. Kells.

Sept. 1955 Mechanical Engineering
An Evaluation of Brass-Powder Structural Parts in Product Engineering, by G. L. Werley.

Oct. 1955 Mechanical Engineering
Residual Stresses in Cold-Finished Steel Bars and Their Effect on Manufactured Parts, by E. S. Nachtman.

Jan. 1956 Mechanical Engineering
Bending and Impact Tests—of Cast-Iron, Cast-Steel, and Nodular-Iron Valve Bodies, by J. O. Jeffrey and R. H. Hanlon.

April 1956 Mechanical Engineering
The Use of Nodular Iron in Switchgear, by F. E. Florschutz. (C)
Vacuum Melting Nickel-Base Alloys on a Production Scale, by F. N. Damara and J. S. Huntington. (C)

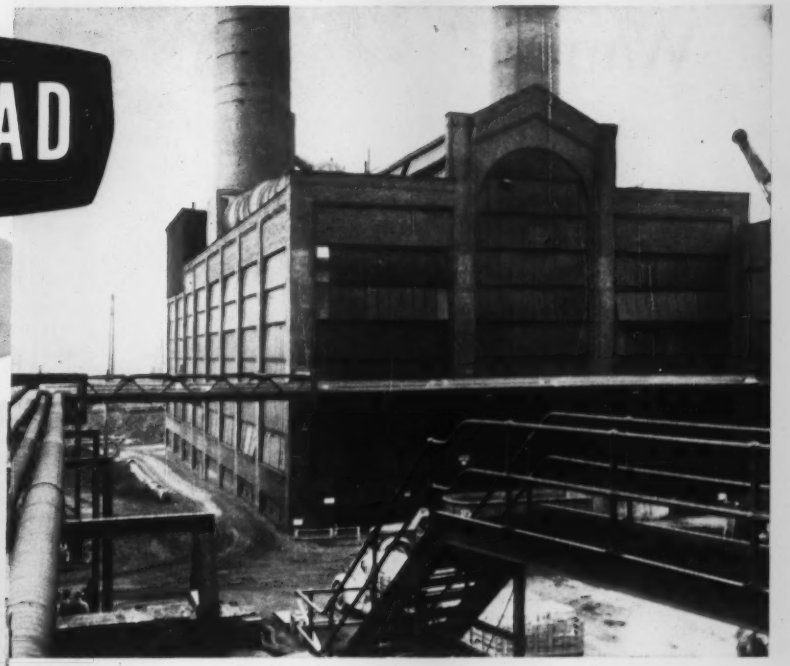
(C) Article has been condensed

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 29 W. 39 St., New York 18, N. Y.

OVERHEAD

OR

underground



Ric-wiL offers the COMPLETE quality line of prefabricated piping systems

Ric-wiL factory prefabricated piping systems, *timed* to your schedule and *shipped* directly to the job site, can save you valuable time and money. Insulated units are available for steam, hot water, oil, other viscous fluids, process liquids and refrigeration lines . . . and remember . . . Ric-wiL is the quality system of exceptionally high mechanical strength and thermal efficiency.

Quality Piping Systems . . .
. . . of Exceptionally High Thermal Efficiency

RIC-WIL INCORPORATED

PREFABRICATED INSULATED PIPING SYSTEMS

BARBERTON, OHIO

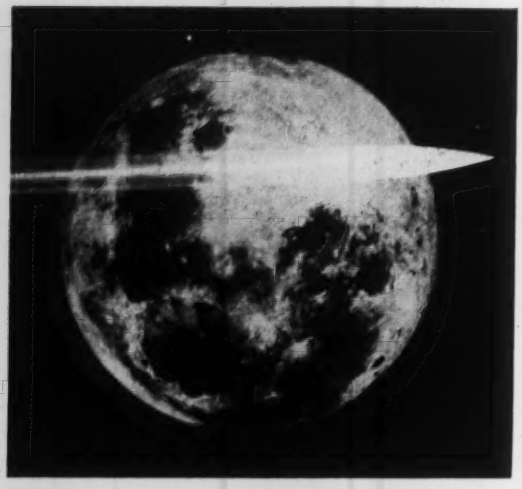
IN CANADA: THE RIC-WIL COMPANY OF CANADA LIMITED

Write for a copy of the new Ric-wiL Catalog . . .

Wanted!

Engineers who will accept the challenge of the most urgent program in the free world today...

Long Range Guided Missiles



Ten years ago there was only a handful of men in the country who said it could be done. Today, more and more engineers—their technological noses scenting the fact that engineering history is in the making—are picking up the gauntlet of the greatest engineering challenge American ingenuity has ever faced—the race against time and the phenomena of long range guided missiles.

Dr. E. R. van DRIEST, Chief Scientist, is nationally recognized for his work in aerothermodynamics. He has a BS, Case Institute of Technology; MS, University of Iowa; Ph.D., Cal Tech; and Sc.D, Technisch Hochschule, Zurich, Switzerland. Around his home, in Whittier, he finds ideal opportunities for the pursuits he and his family like best—horseback-riding, archery and other outdoor activities—perfect complement to the absorbing mysteries of his work.

Research and development that would ordinarily take years is today—of necessity—being telescoped into months. Problems of aerodynamics, thermodynamics, high temperature materials, aeroelasticity—that a decade ago were only theory in textbooks are today being solved. What's more, the production techniques necessary to turn these solutions into hardware have been evolved.

Major Missile Center

One of the major centers of this activity is North American Aviation's Missile Development Division. In 1945 North American started a program of research and development in this field. As far back as 1948, the first NATIV—North American Test Instrument Vehicle—streaked to trajectory altitude of 10 miles. One result of this type of pioneering was complete weapons system responsibility for the Air Force SM-64 Navaho Intercontinental Guided Missile—a gigantic task embracing almost every field of engineering.

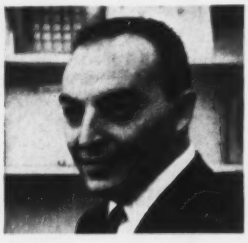
JIM THOMPSON's career in missile engineering at North American began in 1951. Today, Jim is Group Leader of Flight Instrumentation at the Missile Test Facility, Patrick Air Force Base, Florida. The tropical climate there is ideal for his favorite sports—fishing and golf.

Progress Grows Apace

We can't give details here, or describe facilities, solutions, flight tests. But we *can* tell you this: a new engineering chapter is being written. It is reaching its climactic phase. There will never be a better time for you to become a Missile Engineer.

Are You This Kind of Man?

Can you break with tradition... leave conventional methods behind... and explore the unknown with the faith that in every obstacle lies the seeds of new successes?



MANUEL C. SANZ, Chief of Materials Research, found unique scope for his special talents at North American. This Chemical Engineer, with a Masters in Physics and Chemistry, is named as the inventor in a patent on the famous Chem-Mill Process. His son leads a Los Angeles school band—with a chem-milled baton!

If You Join These Men, We Promise You

a management climate which stimulates personal growth—and rewards it with responsibility, professional recognition and material benefits limited only by your own abilities. Your own academic stature can be constantly enlarged with our Educational Refund Plan—and some of the nation's finest universities are close at hand.

Write today for full particulars. If you're the man we're seeking, we'll be glad to arrange a personal interview *where you are now residing.*

Contact: Mr. M. Brunetti, Engineering Personnel Dept. 1-ME
Missile Development Division, 12214 Lakewood Blvd., Downey, California.

NORTH AMERICAN AVIATION, INC.

A Multipress case study

6-ton Denison hydraulic Multipress is used here to press valve lever over shaft; then stake lever securely to shaft.

MULTIPRESS® speeds transmission parts assembly at Chrysler

PRECISION assembly operations for automatic torque converter transmission components are performed quickly and economically by small Denison hydraulic presses at the Indianapolis plant of Chrysler Corporation.

While costs have been reduced, the high quality standards essential in a precision product have been maintained. Maximum operator safety is a Multipress bonus.

Let a Denison hydraulic engineer point the way to improvements in your production methods with the versatile Multipress. Write Denison Engineering Division, American Brake Shoe Co., 1174 Dublin Road, Columbus 16, Ohio.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Wanted: Pioneers for man's last frontier

Help us build power for the conquest of space:

LARGE ROCKET ENGINES

WILLIAM J. CECKA, JR., 35, aeronautical engineer, (Univ. of Minn. '43), was called from North American by the Air Force for experimental rocket work in 1944. On his return, he progressed rapidly: 1948, supervisory test job; 1950, group engineer, operations; 1953 engineering group leader; 1955, section chief of engineering test. Using our refund plan he[illegible] in sight.

GEORGE P. SUTTON, in the 13 brilliant years since receiving his MSME, Cal Tech, has made rocketry a way of life. His reputation is world wide. His book *Rocket Propulsion Elements* is recognized as the standard text on the subject. Still active academically, but no bookworm, he takes time off occasionally to study the laws of motion at some of the world's better ski resorts.

Tomorrow's count down already fills the air at ROCKETDYNE's 1,600-acre Field Test Laboratory in the Santa Susana Mountains near Los Angeles. For this is the free world's largest workshop for rocket engineering—the great new industry that is now attracting many of the finest scientific and engineering minds in the country.

EXACTING RESEARCH, EXCITING PROSPECTS

From the rock-bedded test stands come 2 miles of recordings per day—data far ahead of available texts. The big rocket engine is a flying chemical factory in an absolute state of automation. It tolerates no error. It demands ductwork, turbomachinery, pressure chambers, orifices, injectors, heat exchangers and closed-loop control systems that must put hundreds of pounds of precisely mixed propellants into controlled combustion every second. Tolerances go down to 0.0001". Temperatures range from -250° F to 5000° F. Process time constants occur in "steady state conditions" of the order of a few milliseconds. Event sequences are minutely evaluated, as basis of designed performance predictions of extreme exactitude.

The methods now being developed at ROCKETDYNE for producing effective power to the limits of mechanical stress will have wide application. Such experience is practically unobtainable anywhere else. As a graduate engineer, *you* may be able to participate—now.

What motivates a rocket engineer? Well, the material advantages are high; but it is the work itself that draws him most. He feels the same incentive that moved Magellan . . . spurred the Wright Brothers . . . and beckoned again to Goddard as he flew the first liquid rocket at Auburn, Mass. in 1926.

At ROCKETDYNE, you can do this kind of pioneering in a management climate that stimulates personal growth—and rewards it to the limits of your ability. Academically, too, you can grow with our financial aid; some of the nation's finest universities are close by.

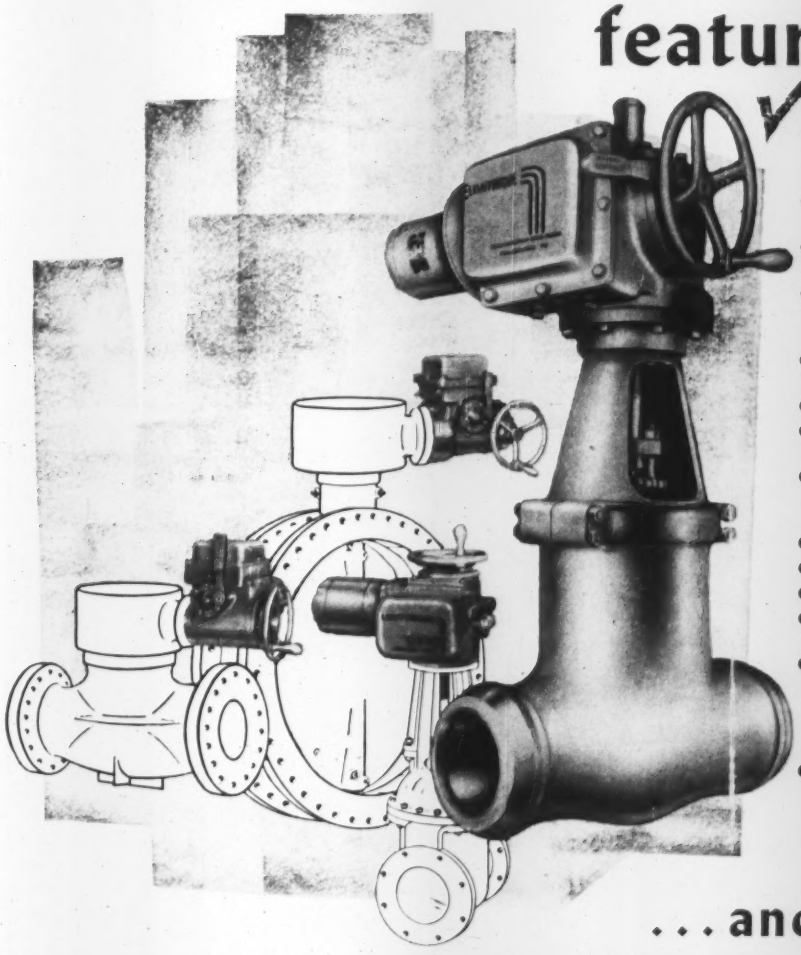
INTERESTING BOOKLET: "The Big Challenge"—facts on design criteria and development approaches used at ROCKETDYNE. Write for your personal copy, specifying your degree and years of post-college experience. Address: A. W. Jamieson, Engineering Personnel Dept. IME, 6633 Canoga Ave., Canoga Park, California.

ROCKETDYNE

A Division of North American Aviation, Inc.

BUILDERS OF POWER FOR OUTER SPACE

Check these features



- Micrometer torque seating switch gives tight valve closure, and protects valve parts from damage.
- Self contained unit—no gears, stem nut or bearings to buy.
- Weatherproof, dust-tight, watertight and explosion-proof construction.
- Hammerblow device . . allows motor to reach full speed, before load is engaged.
- Non-rotating handwheel built into the unit.
- Automatic declutching.
- Motor is disengaged during handwheel operation.
- Can always be declutched for handwheel operation regardless of weather or electrical conditions.
- High torque motors.
- Simple valve yoke.
- May be mounted in any position.
- Three to four times faster handwheel operation.
- Actuation may be by any available power source such as electricity, air, oil, gas, water or steam. LimiTorque is readily adapted for microwave control.
- LimiTorque is designed for plug, butterfly, gate and globe valves up to 96″ diameter . . . Entire Unit and nut can be lifted off valve yoke, by removing flange bolts.

. . . and you'll understand why more *LIMITORQUE* valve controls are in use than all others combined

Send for new catalog L-550, and please use your Business Letterhead when requesting.

LimiTorque®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Limitorque Corporation • Philadelphia

Engineers, when in New York, are saying:

UNEXCELLED OPPORTUNITIES for ENGINEERS

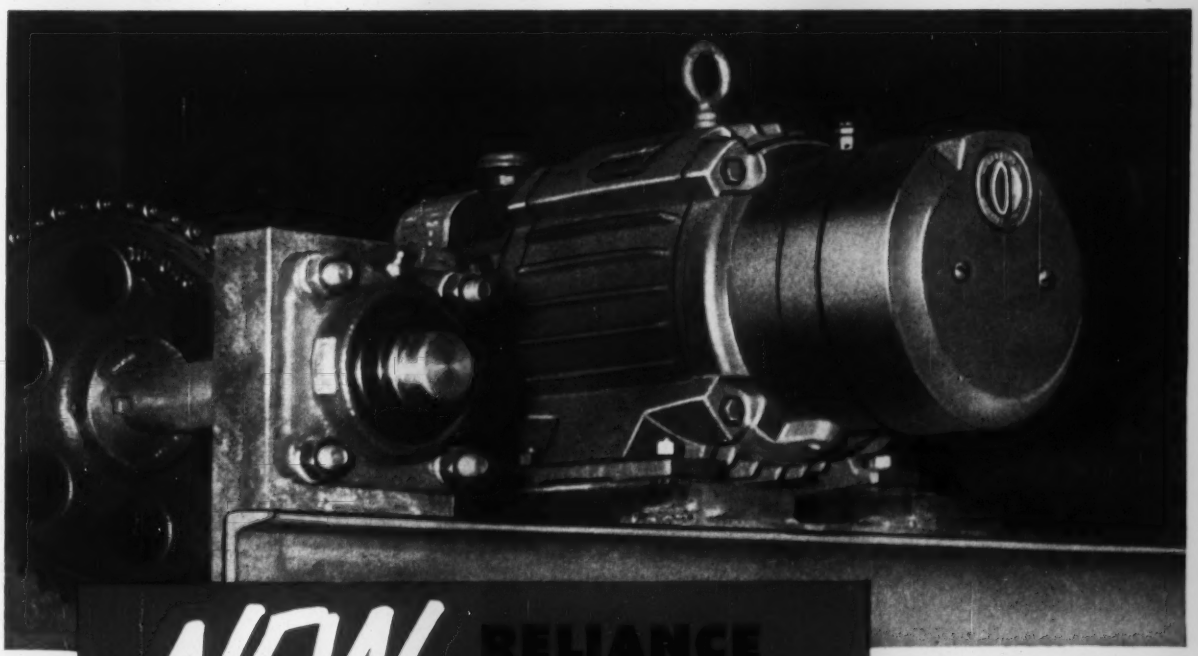
- DESIGN
- CHECKING
- METALLURGY
- DEVELOPMENT
- VIBRATION
- ANALYSIS

They are taking the opportunity to visit

HAMILTON STANDARD'S New York Engineer Interview Headquarters

Don't neglect the opportunity to discuss your future with the Hamilton Standard interviewer at our New York offices in the Governor Clinton, 7th Avenue at 31st Street. Drop in any day, Monday through Saturday, between 10 a.m. and 7 p.m., or to arrange a confidential interview, call W. H. Brownell at PEnnsylvania 6-3400. Discover the many benefits of investing your talents with this expanding leader in the jet aircraft equipment industry.

HAMILTON STANDARD, Div. of United Aircraft Corp., Windsor Locks, Conn.



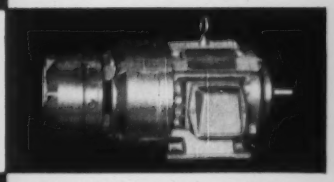
NEW RELIANCE BRAKEMOTOR

These new motors are specifically designed for tough operating conditions. Corrosion-proof cast-iron housings and sealed joints make this motor impregnable to foreign material.

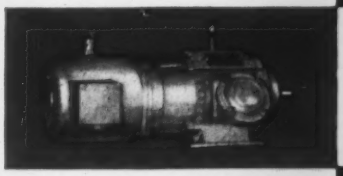
Braking torque ratings from 3 ft. lbs. thru 345 ft. lbs. Fail-safe mechanism immediately applies brake in case of power failure. One piece molded brake linings provide fast, smooth stops and unmatched holding power for heavy loads.

Simple brake has only six parts and requires no control wiring or auxiliary electrical equipment. Compact construction requires a minimum of space. Wearing parts are easily accessible for fast maintenance.

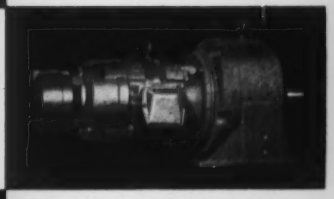
For further information write for bulletin B-2503. B-1533



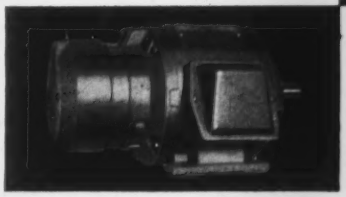
Totally-Enclosed, Corrosion-Proof



Explosion-Proof—Cl. I, Gr. D and Cl. II, Grs. E, F & G



Corrosion-Proof Gearmotor

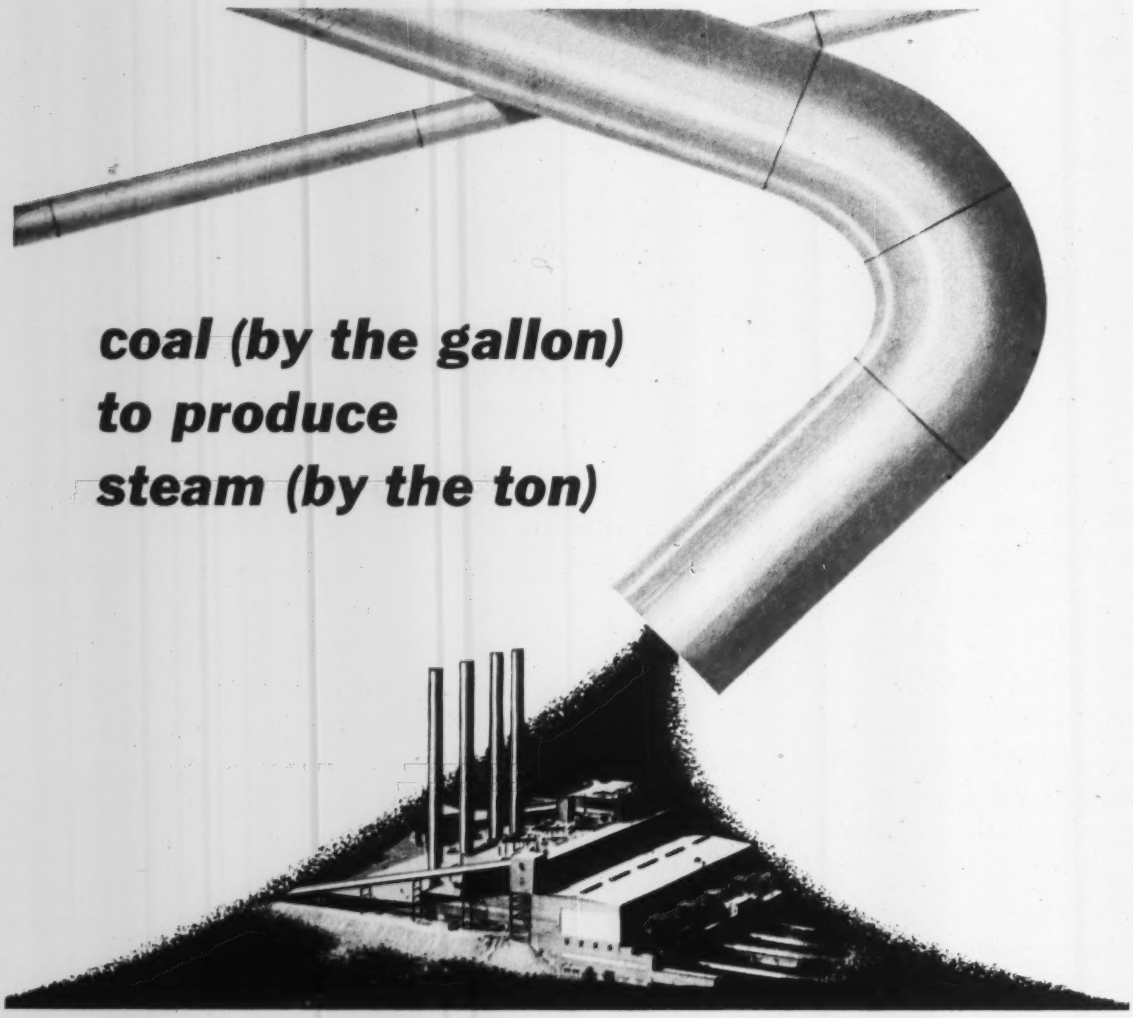


Protected

See Your RELIANCE Sales Engineer TODAY

RELIANCE ELECTRIC AND ENGINEERING CO.

Dept. 291A, Cleveland 10, Ohio • Canadian Division: Welland, Ontario
Sales Offices and Distributors in Principal Cities



coal (by the gallon) to produce steam (by the ton)

In September 1956, the laying of the pipe for the first long-distance commercial *coal pipeline* in the United States was completed. This unique pipeline—108 miles long—is capable of delivering 150 tons of coal per hour . . . from the Georgetown, Ohio, properties of Pittsburgh Consolidation Coal Company to the Eastlake plant of The Cleveland Electric Illuminating Company. The coal will be pumped in the form of a "slurry"—a 50-50 mixture of crushed coal and water.

At Eastlake—one of the country's most efficient power stations—the slurry will be delivered to thickeners, vacuum filters, and a battery of C-E Raymond Flash Drying Systems manufactured by Combustion Engineering. Together, these will remove the moisture at the rate of 36,000 gallons per hour. The dried coal will then be pulverized in C-E Raymond Bowl Mills and burned in four mammoth Combustion boilers of the Controlled Circulation type, together capable of producing over 2,000 tons of steam per hour.

Combustion's participation in this project is another instance of its leadership in pioneering improved means for fuel utilization. Throughout the free world, C-E enjoys a reputation for the most advanced engineering in steam generation and related fields. Whether your steam requirements can best be met by coal, oil, gas, or any of a number of special fuels—and regardless of the type or size of boiler you need—the C-E line of fuel burning and steam generating equipment can supply just the right installation for your needs.

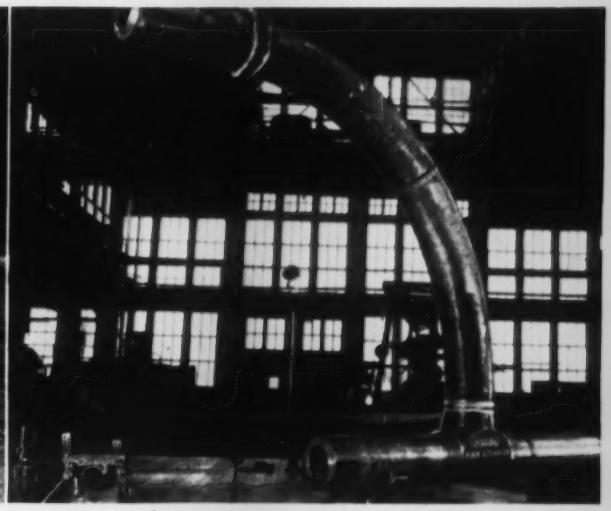
COMBUSTION ENGINEERING

200 Madison Avenue, New York 16, N. Y.
Combustion Engineering Building

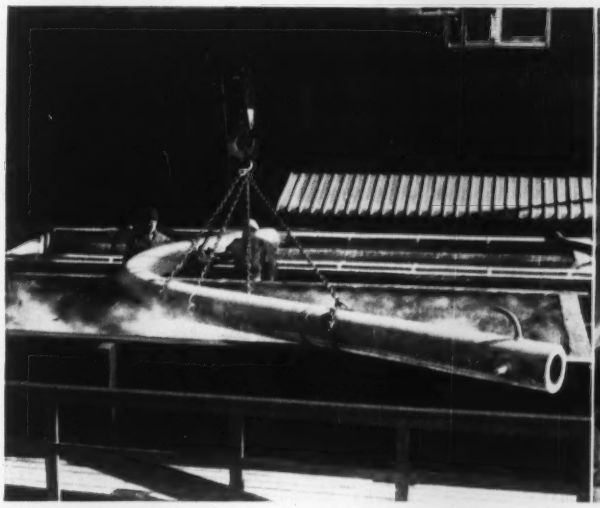
B-959

STEAM GENERATING UNITS; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; HOME HEATING AND COOLING UNITS; DOMESTIC WATER HEATERS; SOIL PIPE

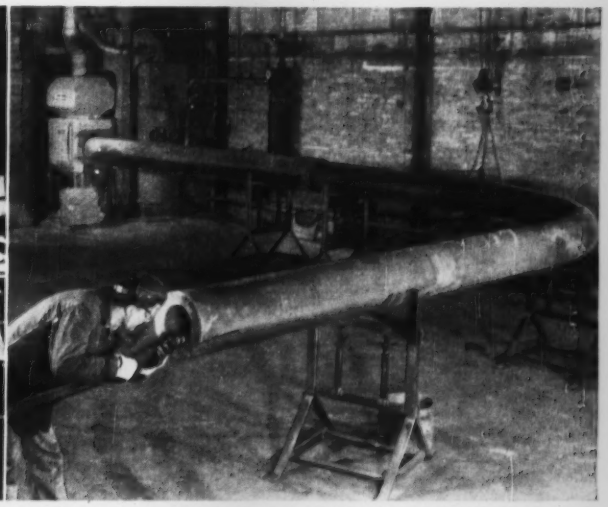
Crane's skilled shopmen bend 17¾" O.D. pipe with 3¼" wall. Pipe bend is for steam service—1970 lbs. at 1050 deg. F.



Experienced Crane welders have welded the bend (see photo 1) to header. Pipe is 2¼% chrome, 1% moly, alloy steel. Unit shown weighed 15,000 lbs.



Pipe bend fabricated by Crane is being pickled as part of cleaning procedure. Pipe is chrome-moly alloy—2.539" wall thickness; 13.578" O.D. Unit weighs 9050 lbs.



Pipe shown at left also was shot-blasted. Combining pickling and shot-blasting assures maximum interior cleanliness.

Let CRANE fabricate your heavy-wall pipe

Do your high pressure-high temperature piping specifications call for bending and fabricating pipe of greater wall thicknesses than the maximums shown in Schedule 160 thicknesses?

Crane shops for years have been processing heavy-wall pipe ranging in thicknesses up to 3.750"; in O.D. pipe sizes from 11.690" to 21.000"!

Crane facilities include bending, welding, upsetting, machining, full furnace stress-relieving or heat treating, radiographic inspection, and thorough interior cleaning.

All Crane facilities are housed under *one* roof for fastest service—and controlled and operated under *one* responsibility. Thus, you are assured of traditional Crane quality in materials, engineering supervision, and skilled shopmanship—that effect important economies in erection, operation, and maintenance for years to come.

For prompt consultation write to address below.

CRANE FABRICATED PIPING

VALVES • FITTINGS • PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

FORMATION D'EAU OXYGENEE PAR ACTION DES RAYONS GAMMA SUR DES SOLUTIONS AQUEUSES $H_2^{16}O - H_2^{18}O$

QUANTUM THEORY OF LINE BROADENING BY AN IONIC PLASMA

Reduction of NaI Background

Discontinuous Servo for Control of Power Reactors

THE PLASTIC DEFORMATION OF URANIUM ON THERMAL CYCLING

Deformation Mechanisms of Alpha-Uranium Single Crystals

FACTORS IN THE RADIOSENSITIVITY OF MAMMALIAN CELLS

Fission Product Kilocurie Source Preparation, Radiation Intensity

On the Consequences of the Possible Existence of the Hyperdeuteron

Allotropic Transformations In Titanium, Zirconium, and Uranium Alloys

Using Intermediate Experiments for Reactor Nuclear Design

Spontaneous Fission Systematics

A Preliminary Study of Superheating Boiling Reactors

THE QUANTITATIVE DETERMINATION OF GAMMA RAY EMITTING ELEMENTS IN LIVING PERSONS

Ionization of Air by Beta Rays from Point Sources

Mechanical Master-Slave Manipulator

Chromatography and Electrochromatography

Continual Injection into Circular Ion Accelerators

Organic Coolant Moderators for Power Reactors

Recoil Type Neutron Spectrometer for 0.05 to 1 Mev

Gaseous Scintillation Counting

Consistent Biochemical Pattern in Malignant Tumors

Einige neue Beobachtungen an photochemisch verfärbten Lithiumfluorid.

SURVEY OF SEPARATION PROCESSES FOR IRRADIATED FUELS

Nuclear Reactor Control

Thermodynamic Properties of Liquid He^3 between 0.23° and 2° K.

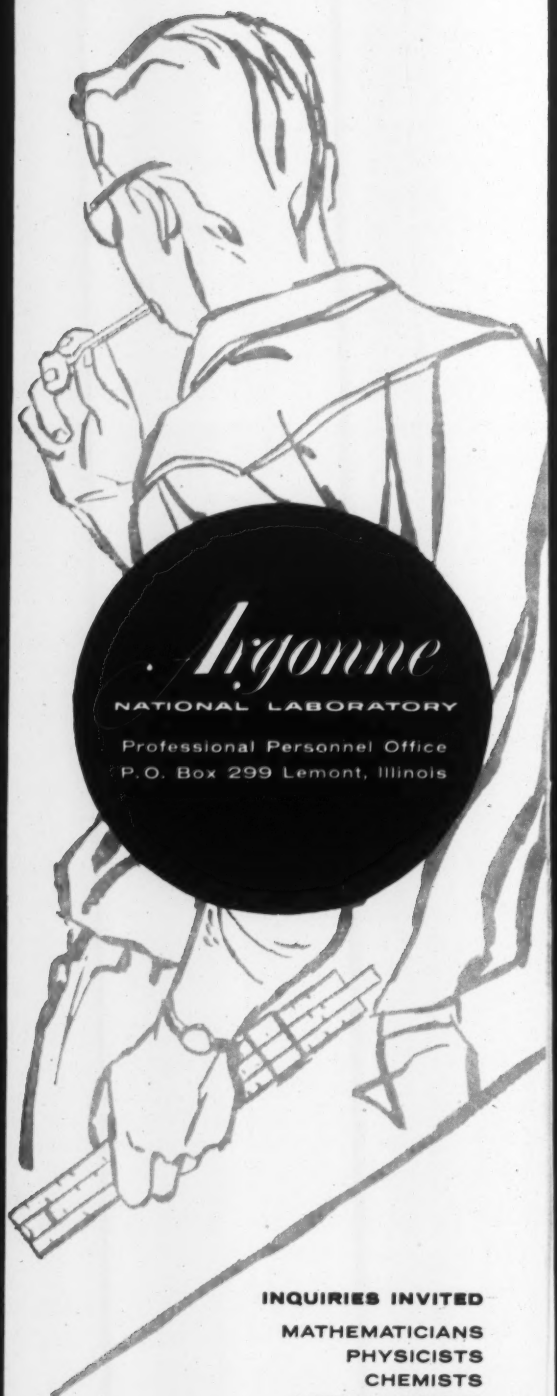
The Condensed System Bromide Trifluoride–Antimony Pentafluoride

Theories of the Earth's Magnetism

Radiation as a Carcinogenic Agent

(SOME RECENT PUBLICATIONS)

creative leadership



Argonne
NATIONAL LABORATORY
Professional Personnel Office
P.O. Box 299 Lemont, Illinois

INQUIRIES INVITED

MATHEMATICIANS
PHYSICISTS
CHEMISTS
METALLURGISTS
CHEMICAL ENGINEERS
METALLURGICAL ENGINEERS
MECHANICAL ENGINEERS
ELECTRICAL ENGINEERS
PHYSICIANS

Father and Son Teams

...a tradition at *Illinois Gear*

Throughout the modern plants of *Illinois* Gear are many father and son teams like the one pictured below.

They typify the fine family spirit which is also engendered by the many other relatives working side by side at *Illinois* Gear.

Fathers, who learned their skills at Illinois Gear, are proud to pass them along to sons who, from early youth, have been steeped in traditions of quality.

Naturally, we are very proud of these many father and son teams. They, and hundreds of other skilled craftsmen of the *Illinois* Gear team, are responsible for the manufacture of the finest gears in America.

For gears that are made right *with quality as the first consideration*—depend on ILLINOIS GEAR.

The intent interest of the younger man in the precision techniques of his father reflects the deep-rooted desire for quality craftsmanship that characterizes every step in the manufacture of Illinois Gears.

Look for this mark ILG® *the symbol on finer gears*

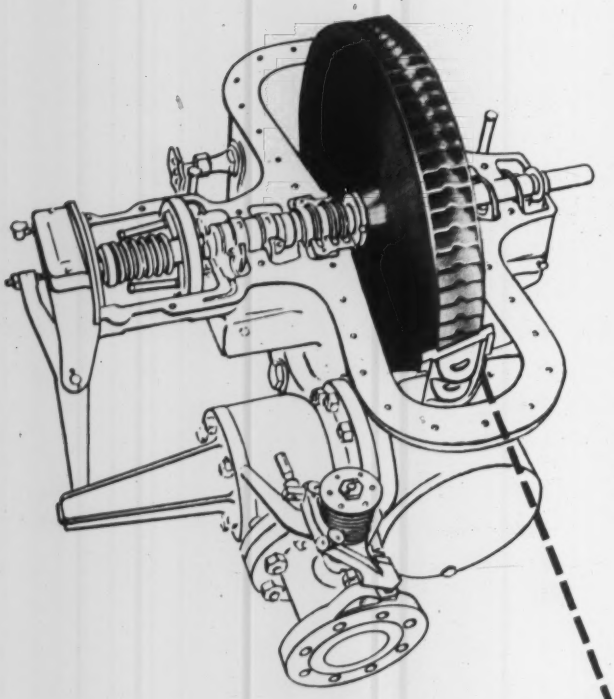
ILLINOIS GEARS Reg. U.S. Pat. Off.

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE • CHICAGO 35, ILLINOIS

Work Horse of Industry..since 1906



The Terry Steam Turbine Company was incorporated in 1906 to manufacture *a workable and efficient prime mover that would operate with minimum maintenance.* This prime mover was the solid-wheel turbine, which had been invented by Edward Clinton Terry a few years before.

Although maintenance practice has improved vastly since then, the demand for the turbine has multiplied many times. *Rising maintenance costs have actually increased the need for trouble-free operation.*

Today, there are more Terry solid-wheel turbines in operation, and there are more built each year, than ever before. The explanation is simple.

Here is a turbine with a virtually indestructible wheel. Made of a single forging of special composition steel, there are no separate parts to loosen or work out. As the only function of the blades is to form a series of pockets, any wear which may occur does not materially affect horsepower or efficiency.

Blades will not foul. They have large clearances and are further protected by the projecting rims at the sides of the wheel. As the side clearances are also very large, end play can do no harm.

These are a few of the reasons why the Terry solid wheel turbine has been the *work horse of industry — since 1906.* For the full story, send for a copy of Bulletin S-116.

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD 1, CONN.

TERRY

1906 was the year this turbine was built in Terry's plant. It is believed to be one of the first small direct-connected turbines built for commercial use in the United States.

TT-1203

ALL 100

General Motors • Standard Oil (N.J.) • Ford Motor • U.S. Steel • Chrysler • General Electric • Swift • Bethlehem Steel • Armour • Du Pont (E.I.) de Nemours • Gulf Oil • Western Electric • Socony Mobil Oil • Standard Oil (Ind.) • Texas Co. • Shell Oil • Westinghouse Electric Goodyear Tire & Rubber • Standard Oil of California • National Dairy Products • Republic Steel • Union Carbide & Carbon • International Harvester Firestone Tire & Rubber • Sinclair Oil • Radio Corp. of America • Procter & Gamble • U. S. Rubber • Cities Service • Phillips Petroleum • Douglas Aircraft • Boeing Airplane • Aluminum Co. of America • General Foods • North American Aviation • Borden • International Paper • Goodrich (B.F.) American Can • Eastman Kodak • United Aircraft Corp. • Jones & Laughlin Steel • Armco Steel • Sperry Rand • General Dynamics • Lockheed Aircraft • Continental Can • Sun Oil • American Metal • Inland Steel • Wilson & Co. • Anaconda Co. • Allied Chemical & Dye • National Steel Corp. • Youngstown Sheet & Tube • American Tobacco • Pittsburgh Plate Glass • Bendix Aviation • Internat. Business Machines • Olin Mathieson Chemical • Borg-Warner • Kennecott Copper • Republic Aviation • American Smelting & Refining • Allis-Chalmers • National Lead • Continental Oil Caterpillar Tractor • Monsanto Chemical • Burlington Industries • General Mills • Atlantic Refining • Curtiss-Wright • Pure Oil • Studebaker-Packard Tide Water Associated Oil • Dow Chemical • Reynolds (R.J.) Tobacco • American Cyanamid • Internat. Tel. & Tel. • American Motors • Grace (W.R.) Crown Zellerbach • Standard Brands • National Biscuit • Foremost Dairies • Ralston Purina • Reynolds Metals • Campbell Soup • Philco • Owens-Illinois Glass • Merritt-Chapman & Scott • Union Oil • Singer Manufacturing • Phelps Dodge • United Merchants & Manufacturers • Pillsbury Mills Standard Oil (Ohio) • American Radiator & Standard Sanitary • Deere

of America's 100 largest industrial corporations are users of Clarage air handling and conditioning equipment.

CLARAGE FAN COMPANY
KALAMAZOO • MICHIGAN

Source: The Fortune Directory • Published July 1956

If you're expecting to read another offer of career opportunities presented on a silver platter, together with a certified rosy future neatly packaged in Fate-proof plastic—stop right here.

On the other hand, if you realize that all the bright promises and special inducements in the world cannot alter the fact that hard work, ability, and the drive to apply them are the things that make and seize real opportunities—you'd do well to read on.

Don't get the idea, because of the foregoing, that we underrate ourselves in any way. Quite the contrary. We know that our work—design and development of nuclear weapons—is as important as any being done today. We know that our working conditions and employee benefits are second to none. We know that we provide real opportunities for growth and advancement—for qualified people who have what it takes. We know, too, that living conditions at our locations—in terms of climate, housing, schools, recreation, and cultural facilities—are hard to match anywhere. At the same time, we know that it's up to you to decide whether or not you agree with us. We also have the idea that it's up to you to convince us of your ability.

If you'd like to know more about us—our work, our background, and both our laboratories, one in Albuquerque and one near San Francisco, we'll be happy to send you our illustrated brochure that tells the whole story. Just write to Staff Employment Division 553.

SANDIA CORPORATION

ALBUQUERQUE, NEW MEXICO

Rust-Oleum is distinctive as your own fingerprint. Accept no substitute.

. . . goes on faster, stops rust, lasts longer over rust!

ONE MAN often does the work of two!

EASIER TO USE—because Rust-Oleum 769 Damp-Proof Red Primer goes over rusted metal after scraping and wirebrushing to remove rust scale and loose rust—usually eliminating costly surface preparations. *Stops Rust*—because Rust-Oleum's specially-processed fish oil vehicle *penetrates* rust to bare metal—driving out air and moisture that cause rust.

LASTS LONGER applied over rust—and teamed up with Rust-Oleum's many attractive finish coatings, assures lasting beauty. Try Rust-Oleum on *your* tanks, metal sash, machinery, wire fences, stacks, girders—or around *your* home. Prompt delivery from Industrial Distributor stocks. Write for illustrated literature with color charts showing colors and applications.

RUST-OLEUM CORPORATION • 2610 Oakton Street • Evanston, Illinois

RUST-OLEUM®

30% GREATER COVERAGE—MANY ATTRACTIVE COLORS

Rust-Oleum covers up to 30% more area, depending upon surface condition and porosity. And you can beautify as you protect with Rust-Oleum finish coatings in Aluminum, White, Red, Gray, Green, Blue, Yellow, Black, etc.

STOPS RUST!®

Rust-Oleum and Stops Rust are brand names and registered trademarks of the Rust-Oleum Corporation.

Write for special report showing Rust-Oleum penetration to bare metal.

UNIVERSITY OF CALIFORNIA RADIATION LABORATORY

UCRL

BERKELEY
LIVERMORE

Can you help add to these achievements?

The cyclotron

The synchrotron

The proton linear accelerator

The Bevatron

Electromagnetic separation of uranium-235

Discovery of plutonium and many other transuranium elements

Discovery of
URANIUM-233
TRITIUM
CARBON-14
IRON-59
IODINE-131

Discovery of the antiproton and antineutron

Artificial production of mesons

These accomplishments in pure and applied science are widely known. To this impressive list, scientists and engineers at the Laboratory's Livermore site are making equally important contributions in the fields of nuclear weapons design, nuclear rocket propulsion, controlled thermonuclear energy (Project Sherwood) and high current accelerators.

What you can do to help add to these accomplishments is limited only by yourself—your *ability* and your *interest.*

For the University of California Radiation Laboratory is managed and directed by outstanding scientists and engineers.

These men are your "team-mates"... offering pioneering knowledge of the nuclear field and the newest, most expansive laboratory facilities. Here—where new ideas and techniques are traditional—initiative is constantly encouraged and developed.

IF YOU are a **MECHANICAL** or **ELECTRONICS ENGINEER,** you may be involved in a project in any one of many interesting fields, as a basic member of the task force assigned each research problem. Your major contribution will be to design and test the necessary equipment, which calls for skill at improvising and the requisite imaginativeness to solve a broad scope of consistently unfamiliar and novel problems.

If you are a **CHEMIST** or **CHEMICAL ENGINEER,** you will work on investigations in radiochemistry, physical and inorganic chemistry and analytical chemistry. The chemical engineer is particularly concerned with the problems of nuclear rocket propulsion, weapons and reactors.

If you are a **PHYSICIST** or **MATHEMATICIAN** you may be involved in such fields of theoretical and experimental physics as weapons design, nuclear rockets, nuclear emulsions, scientific photography (including work in the new field of shock hydrodynamics), reaction history, critical assembly, nuclear physics, high current linear accelerator research, and the controlled release of thermonuclear energy.

In addition, you will be encouraged to explore fundamental problems of your own choosing and to publish your findings in the open literature.

And for your family—there's pleasant living to be had in Northern California's sunny, smog-free Livermore Valley, near excellent shopping centers, schools and the many cultural attractions of the San Francisco Bay Area.

You can help develop tomorrow—at UCRL today

Send for complete information on the facilities, work, personnel plans and benefits and the good living your family can enjoy.

© UCRL

UCRL

53-2-3

DIRECTOR OF PROFESSIONAL PERSONNEL
UNIVERSITY OF CALIFORNIA RADIATION LABORATORY
LIVERMORE, CALIFORNIA

Please send me complete information describing UCRL facilities, projects and opportunities.

*My specialty is*_____

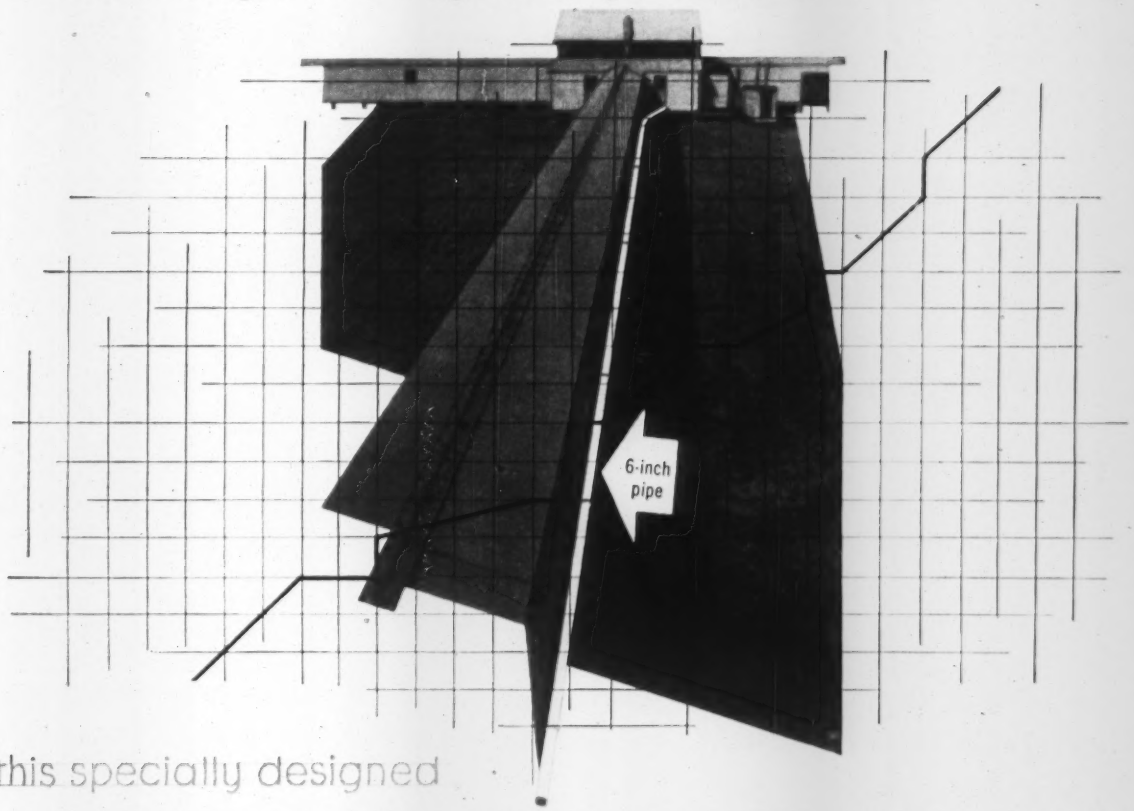
*My degree(s) are*_____

*Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

Hoffman engineered systems get **results:**



this specially designed

HOFFMAN PNEUMATIC CONVEYING SYSTEM

improved safety and cut costs in transporting **TNT!**

In this arsenal TNT has to be taken from the box-opening and screening building to another building approximately 500 feet away for melting.

The old system: A powered screen discharged TNT into wheeled buggies that were pushed by hand along the 8-foot enclosed ramp shown above. At the other end, each buggy was taken up to the third floor, in one of two freight elevators, and the TNT was fed to the melting equipment.

The new system: TNT is conveyed directly from screening to melting through a 6-inch pipe, at a rate up to 200 pounds per minute, although no more than one 50-pound increment is being conveyed through the pipe at any given time. No handling. No buggies. No elevators.

Results: (1) Hoffman furnished a double damper valve that handles the TNT safely and automatically meters its flow. (2) The control of the interrupted stream of conveyed explosives maintains the safe separation of different operations. (3) The pneumatic system paid for itself in the first 18-months' labor saving.

In new construction, the elimination of the ramp and freight elevators would more than pay for the pneumatic conveyor, disregarding the labor savings involved. This is usually the case, comparing Hoffman pneumatic systems with other material handling methods.

Consider how much **you** can save moving material pneumatically. Your letter will bring more information or the services of a trained representative, without cost or obligation.

AIR APPLIANCE DIVISION **U.S. HOFFMAN MACHINERY CORPORATION** DEPT. M.E., 103 FOURTH AVENUE, N.Y. 3, N.Y.

ORDNANCE EQUIPMENT DIVISION Special Pneumatic Conveying Systems, High Efficiency Centrifugal Separators, Stationary and Portable Vacuum Cleaning Equipment, Process Equipment, Pneumatic Systems for Radioactive Materials. **AIR APPLIANCE DIVISION** Multistage Centrifugal Blowers and Exhausters, Pneumatic Conveying Equipment, Industrial Vacuum Cleaning—Portable and Stationary Systems, Continuous Metal Strip Driers, "Smoothflow" Fittings and Tubing. **INDUSTRIAL FILTRATION DIVISION** Machine Tool Coolant Clarifiers—Flotation, Mechanical, and Magnetic, Lubricating and Insulating Oil Conditioners, Filters, and Vaporizers, Solvent Recovery Systems—Vacuum Stills and Filters.

YOU ARE CORDIALLY INVITED TO VISIT OUR BOOTH #510 AT THE PLANT MAINTENANCE SHOW

GRAMIX® BRONZE BEARINGS AND IN NEW Sunbeam PRODUCTS

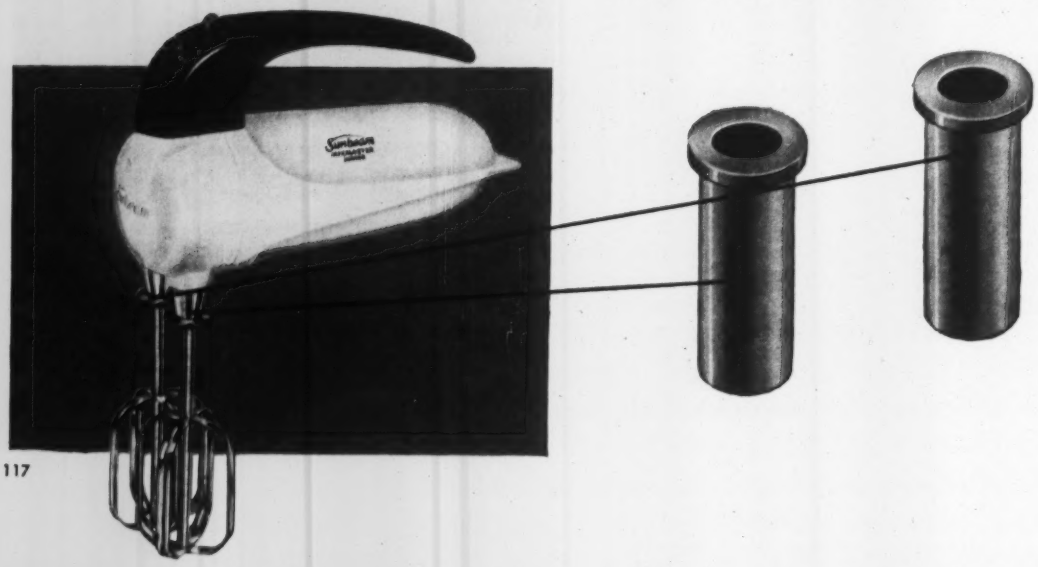
GRAMIX® ALLOYS

(PRODUCT OF POWDER METALLURGY)

The new Sunbeam Mixmaster Junior* does kitchen mixing chores quickly and efficiently and one of the important factors in its fine performance is the use of GRAMIX bearings on the beater spindle shafts. These sintered metal bearings, which are produced from GRAMIX Grade 81 alloy, are oil-impregnated for self-lubrication and are quiet running in operation. One of the outstanding features of these GRAMIX bearings is the fact that they are exceptionally long in relation to the comparatively small diameter. Yet there is no taper or "bell mouth" effect present and tolerances are held to .001 on both the ID and OD. The bearing offers maximum load-carrying surface throughout its length. In addition, Sunbeam engineers have found that GRAMIX gives them a controlled, consistent density in all sections of the bearing. This is another case where GRAMIX bearings have been specifically engineered and produced to fit the needs of the application. Can the same be done for your products?

Made and guaranteed by the Sunbeam Corporation, Chicago, Illinois

NEW SUNBEAM MIXER WITH GRAMIX SELF-LUBRICATING BRONZE SHAFT BEARING



117

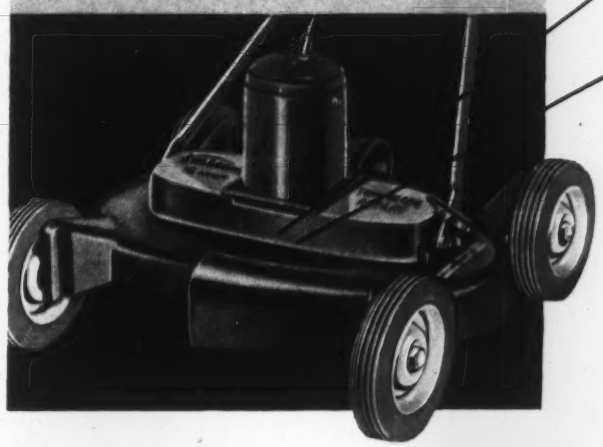
THE UNITED STATES

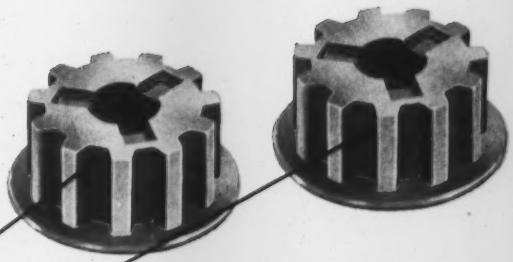
GRAPHITAR® CARBON-GRAPHITE • GRAMIX® SINTERED METAL PARTS • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

GRAMIX® IRON SPROCKETS

PROVE VERSATILITY OF

NEW SUNBEAM ELECTRIC LAWN MOWER WITH IRON GRAMIX DRIVE SPROCKET





In the new Sunbeam twin blade electric lawn mower, power is transmitted from the motor to the cutting blades via cog belt drives. Among the most important parts in this power transmission system are a pair of drive sprockets which must stand up under hours of rugged operation. For these critical parts, Sunbeam Corporation engineers have specified GRAMIX sintered metal sprockets produced to their exact specifications from GRAMIX iron alloy 78. This dual purpose part acts as both a bearing and a sprocket. The excellent bearing characteristics of this GRAMIX alloy eliminates need for special inserts etc., yet the sprocket itself withstands shock loading and maintains a constant coefficient of friction. The contour of the sprocket teeth is maintained under the most severe operating conditions. Additional benefits that Sunbeam engineers have found in GRAMIX include the compatibility of GRAMIX with the belt material and the fact that there is less operational noise. Again, this is a case where the GRAMIX process has produced a part specifically engineered to meet exact product requirements . . . why not investigate the advantages of GRAMIX parts for your designs?

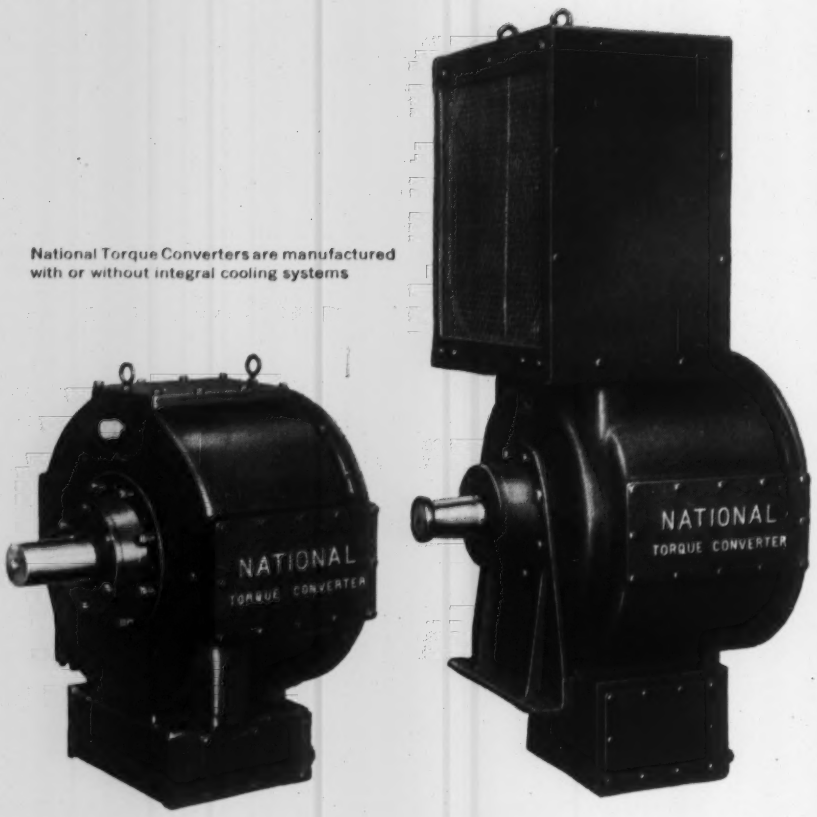
WRITE FOR THIS BOOK

Because GRAMIX parts are die-pressed to shape, then sintered, they are usually much more economical than machined parts. Tolerances as close as .0005" can be held, and the parts oil-impregnated for self-lubrication. Other facts of value to the manufacturer and the design engineer are contained in GRAMIX Engineering Bulletin No. 21. Write today to The United States Graphite Company, Saginaw, Mich.

GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

National Torque Converters are manufactured with or without integral cooling systems



Plan now to DESIGN with National Torque Converters

The simplicity of design of National Single-Stage Torque Converters permits exact matching of torque converter to prime movers of 100 to 1000 horsepower. Installation is simple and easy on stationary as well as mobile equipment. When matched to your prime mover, the National Torque Converter assures uniform top performance on every job. It will give your equipment a constant flow of smooth, steady power over a wide range of loads. It permits quicker starting and faster acceleration of loads, with no lugging or stalling of the prime mover. The torque converter absorbs the shock of sudden overloads, permitting the prime mover to operate at all times at governed or optimum speed.

Our engineers will gladly discuss the application of National Torque Converters to your equipment and help you select exact size and torque capacity. Why not call on them? Or write for Bulletin No. 468.

THE NATIONAL SUPPLY COMPANY

INDUSTRIAL PRODUCTS DIVISION

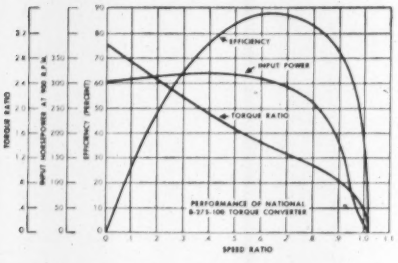
Two Gateway Center, Pittsburgh 22, Pa.

Pace-setters in the progress of industrial power transmission

Consider these National Torque Converter features

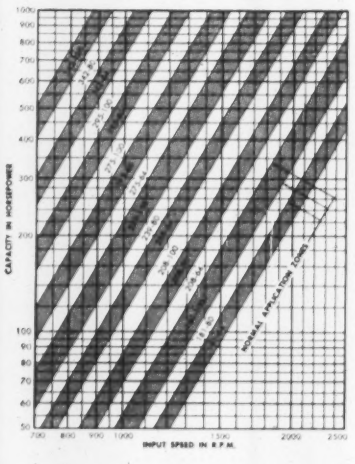
- SIMPLICITY OF DESIGN for ease of installation, operation and maintenance
- FULL RANGE OF CIRCUIT SIZES permits exact matching to prime movers of 100 to 1000 horsepower
- TOP PERFORMANCE enables engine or motor to operate at its optimum speed . . . deliver maximum horsepower constantly
- REPRODUCIBLE EFFICIENCY assures uniform top performance on every job
- FASTER JOB CYCLES means more loads per equipment per operator per day
- UNSURPASSED DURABILITY provides longer service life with minimum maintenance

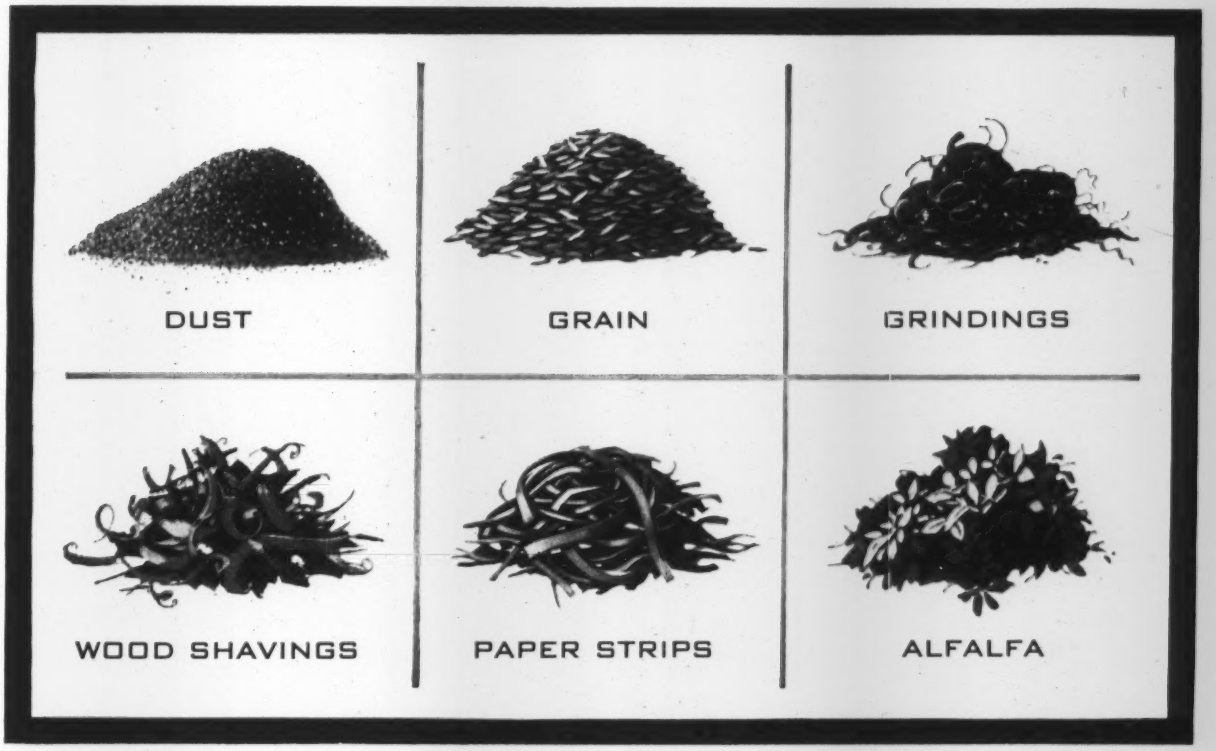
Typical performance curves



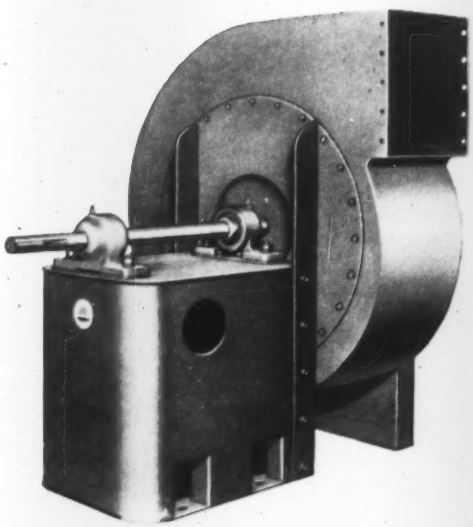
Curve shows torque-speed ratio for series B-275-100 National Torque Converter. Performance Curves of all six sizes and 17 hydraulic circuits covering the 100 to 1000 horsepower range are available on request.

National Torque Converter Capacity Chart





American Blower Industrial Fans take large or small particles right in stride!



Lick tough process applications with the versatile American Blower Industrial Fan.

The secret is their versatility. You see, the American Blower Industrial Fan is available with three types of wheels: Type AH for air handling, Type MH for material handling, Type LS for long shavings.

And there's a wide range of fan arrangements, optional constructions—for severe duties or high-temperature operation—and optional accessories to allow fan modification to suit an individual job.

What's more, it's available as a packaged fan—that is, a self-contained unit with its own motor, drive and weather-proof hood enclosure. This eliminates the need for a separate motor foundation, and the complications of motor lineup, belt centers and weather protection.

If you have a process application involving air, gas, or material handling, why not consider our industrial fan? Your nearest American Blower branch-office man is the one to call. His intimate knowledge of the special problems of many industries—and his complete product line—is at your disposal.

American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products.

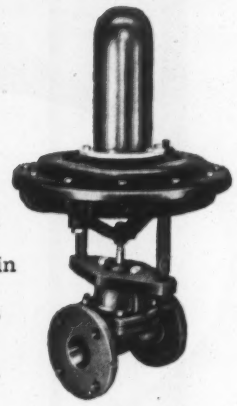
AMERICAN BLOWER

Division of AMERICAN-Standard

Needle Valves

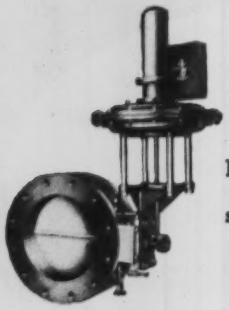
Rugged, outstanding performers for proportional control of small flows. Interchangeable seat rings and plugs. For water, gas, steam, chemicals. Trim and body materials available for "difficult" fluids. Shown here with unique *reversible* Stabilflo Motor.

GET THE BEST



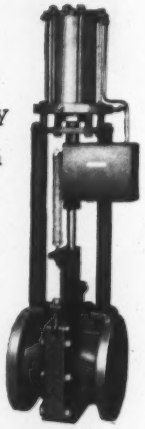
Saunders Type Valves

A complete line, particularly suited to handling of highly corrosive fluids, or fluids containing solids in suspension. Available with Stabilflo Motor as shown, or with Stabiload Cylinder and Power Positioner.



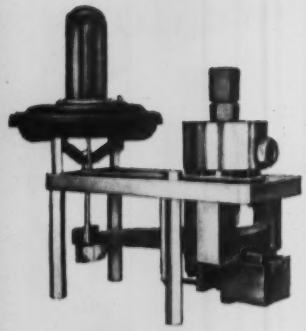
Butterfly Valves

Light and heavy duty types, with angle or swing-through seating, in spool or wafer body style, for low pressure air, gases in combustion control, steam, high pressure gases and liquids, etc. Available with Stabilflo Motor (shown) or cylinder operator.



Gate Valves

Guillotine-type slide valves, specially designed to handle pulp fibre, slurries, and similar fluids. Available with Stabiload Cylinder and Power Positioner as illustrated, for throttling service, or with 4-way pilot valve for on-off service.



Super-Pressure Valves

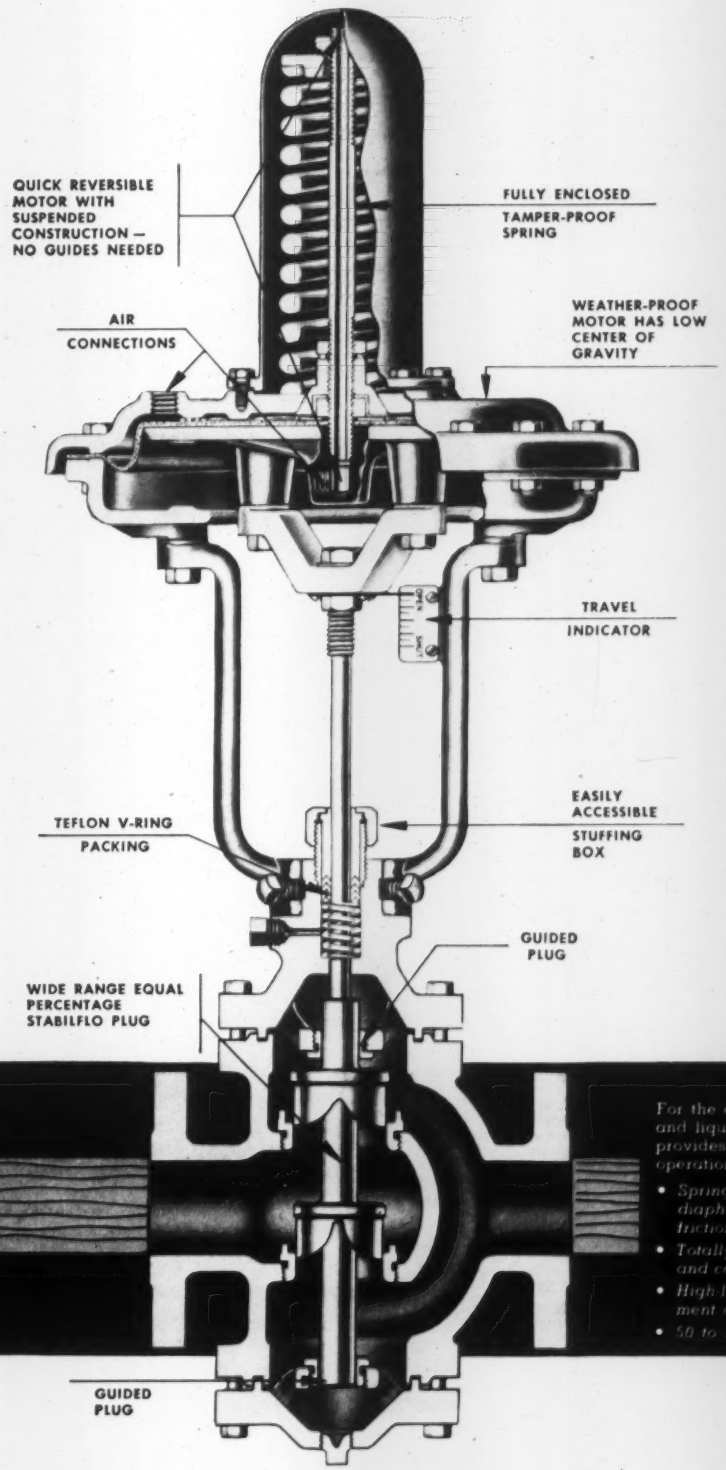
For throttling or let-down service up to 30,000 psi. Features an exclusive high-pressure bellows seal. Port sizes and connections to meet high pressure process specifications.

FOXBORO CONTROL VALVES

8 Strategic Branch Shops for Coast-to-Coast Service: **Pittsburgh, Pa. • Chicago (Skokie), Ill. • Dallas, Tex. • Houston, Tex. • San Francisco (San Leandro), Cal. • Los Angeles, Cal. • Montreal, Que. • Vancouver, B. C.**

SOLUTION TO YOUR CONTROL VALVE PROBLEMS

...with Foxboro Pneumatic Control Valves


QUICK REVERSIBLE MOTOR WITH SUSPENDED CONSTRUCTION — NO GUIDES NEEDED
FULLY ENCLOSED TAMPER-PROOF SPRING
WEATHER-PROOF MOTOR HAS LOW CENTER OF GRAVITY
AIR CONNECTIONS
TRAVEL INDICATOR
EASILY ACCESSIBLE STUFFING BOX
TEFLON V-RING PACKING
GUIDED PLUG
WIDE RANGE EQUAL PERCENTAGE STABILFLO PLUG
GUIDED PLUG

You can always be sure of getting the control valve best suited to flow conditions and control actions when you specify Foxboro. No other single source offers such a wide variety of control valves for specific applications. None other has Foxboro's experience in applying them — in every phase of industrial processing.

Your choice extends from valves for simple on-off control at one extreme, to specialized proportioning control at the other; for high vacuum work to operation at 30,000 psi; for temperatures from −350° to +1000°F. And there's a wide choice of plug designs — and of alloys and trim to handle even severely corrosive and erosive fluids.

You can save shipping cost and time, too, buying direct from Foxboro's strategically located branch shops. They're staffed by experts.

A few typical control valves from Foxboro's complete line are illustrated here. For full details, or specific information on *your* problem, call your nearby Foxboro Field Engineer or write **The Foxboro Company, 961 Neponset Ave., Foxboro, Mass.**

STABILFLO CONTROL VALVES

For the great majority of temperature, pressure, flow, and liquid level control applications, this basic valve provides unsurpassed sensitivity and troublefree operation. Unique design features:

- *Spring-above-diaphragm construction makes diaphragm motor self-aligning, virtually free from friction and hysteresis.*
- *Totally enclosed spring protects against tampering and corrosion.*
- *High-lift wide range V-port provides greater increment of lift for given change in air pressure.*
- *50 to 1 rangeability — equal percentage characteristics.*

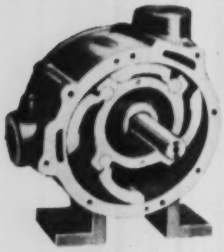
Imperial

the world's finest

TRACING CLOTH

In drafting rooms throughout the world Imperial quality is the standard by which fine tracing cloths are judged. This has been true for decades, and Imperial remains the finest tracing cloth because its makers have continued to improve its quality and value.

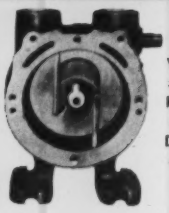
LEIMAN AIR PUMPS maintain rated capacity for years and years



4 WING TYPE

Vacuums to 20" Hg. Pressures to 15 psig. Displacement to 162 c. f. m.

VACUUM —up to 29.9" Hg.
PRESSURE —up to 20 psig.



2 WING TYPE

Vacuums -to 29.9" Hg. Pressures -to 20 psig. Displacement -to 40.8 c. f. m.

Take up their own wear to assure leakproof seal

Wear and trouble have been designed out of Leiman Air Pumps. The rotating wings (cast iron in the 4-wing type, steel in the 2-wing type) hone the cast iron cylinder walls to glassy smoothness. Negligible wear is automatically taken up, maintaining "new pump" efficiency for periods of 10, 15 and 20 years.

Leiman Air Pumps have fewer moving parts—no tips or blades to renew—need no maintenance except occasional oiling—run quietly and trouble-free. Wide range of sizes and models for countless vacuum, suction and pressure jobs. Distributors and engineering assistance available in all industrial centers.

LEIMAN
Rotary Air and
VACUUM PUMPS

Write for 12-page Catalog and Application Book showing 60 "how-to-do-it" blueprints.

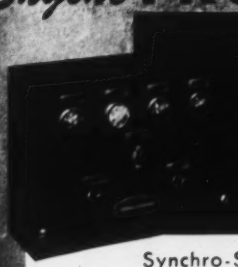
LEIMAN BROS., Inc.
118 Christie St., Newark 5, N. J.

Engine PROTECTION

WITH

Synchro-Start

SAFETY ALARMS



Synchro-Start SAFETY ALARM SETS automatically warn with visual and audible signals as soon as such conditions as low oil pressure, low air pressure and overheating, etc. occur.

Three switches are provided—control "on-off"—test—audible alarm cut-off. For added protection these alarm sets may be equipped with automatic shut-down in case signals are not heeded.

Further information upon request.

SYNCHRO-START PRODUCTS
INCORPORATED
8151 N. RIDGEWAY AVE. • SKOKIE, ILL.

Telephone in *Quiet!* with a BURGESS-MANNING "Hear-Here" Booth

More than "just a phone booth," every Burgess-Manning "HEAR-HERE" Booth is a room of "Quiet." They have been carefully studied from an acoustic standpoint and you will completely eliminate all interfering outside noise when you step inside. And notice too—

- **No doors** — always fresh air
- **No Corners** — to sweep
- **No glass** — to break

There's a model and size to fully satisfy your particular need. No other Booths like the Burgess-Manning.

Performance Guaranteed

Write for Catalog—Bulletin

Architectural Products Division of
BURGESS-MANNING COMPANY
5986 Northwest Highway, Chicago 31, Illinois

Manufacturers of 3-Way Functional Ceilings and Acousti-Booths for Telephoning

LENAPE MANWAYS and FITTINGS

11 x 15" N Fitting.

A wide variety of access openings.

Lenape elliptical access openings (straight rings or flued and curved saddles) and fittings, of the pressure loaded or "self-energized" type are produced in sizes ranging from 4" x 6" to 18" x 24".

Typical Lenape Fittings

- 11 x 15" Type L 150 PSI in steel, Everdur, and 304 Stainless.
- 11 x 15" Type N 450 PSI for general application.
- 11 x 15" Type S 250 PSI with external split recessed clamp plate for paper machine dryers
- 12 x 16" Type N 450 PSI for general application.
- 12 x 16" Type HP 800 PSI for heavy duty.
- 14 x 18" 300 PSI Hinged for beverage tanks.
- 18 x 24" 200 PSI for large clean-outs.

Full details are found on pages 42 to 49 of Lenape Catalog 10-53.

LENAPE HYDRAULIC PRESSING & FORGING CO.
DEPT. 114 WEST CHESTER, PA.
RED MAN PRODUCTS

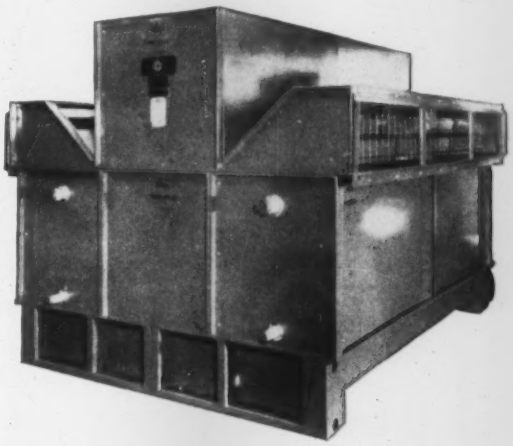
"MONOBALL"®
Self-Aligning Bearings

CHARACTERISTICS

	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Moly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Moly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally-threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line.

SOUTHWEST PRODUCTS CO.
1705 SO. MOUNTAIN AVE., MONROVIA, CALIFORNIA



NIAGARA SECTIONAL Aero HEAT EXCHANGER

gives close temperature control, saves you **LABOR, Power, Water**

- **Because the new design improves the heat transfer to the out-door air by evaporation.**
- **Because new features keep equipment working for long life with "new plant" efficiency...always full capacity.**
- **Because you save 95% of cooling water cost.**

You get faster, more accurate cooling of industrial fluids to specified temperatures.

You improve your quality of production by removing heat at the rate of input.

You save labor in upkeep. With full access to all interior parts and piping you see everything in easy inspections. You head off dirt accumulation and corrosion. Casing panels are removable without moving the coils. The coils can be cleaned from both sides.

First cost is low; freight is low because of the lowest space/weight ratio; you save much labor in erection. Capacity range is 7,000,000 to 18,000,000 Btu/hr. No other heat exchange method gives you so much saving in money and convenience.

Write for Niagara Bulletin 132. Ask for the full story of how you can save expense in your plant and improve your product's quality.

NIAGARA BLOWER COMPANY

Dept. M. E., 405 Lexington Avenue
NEW YORK 17, N. Y.

District Engineers in Principal Cities

NIAGARA — *Over 40 Years' Service in Industrial Air Engineering*

Laboratory precision at mass production costs!

LINEAR ROTO-MOLD "O" RINGS

Do you have the facts on Linear's new, exclusive ROTO-MOLD process? It brings *automation* to the packing industry—makes possible fast delivery of perfectly uniform "O" Rings in any quantity!

★ Linear ROTO-MOLD "O" Rings are made with laboratory precision in single cavity molds under individually controlled pressure. Molding dies are automatically brought into microscopic alignment.

★ Every ROTO-MOLD "O" Ring is perfectly circular in cross section, with no transverse or other seams. You get precise uniformity without trimming or grinding.

Linear ROTO-MOLD "O" Rings are available now, in a variety of sizes and compounds, to meet your exacting requirements. Write, phone or wire for complete details.

"PERFECTLY ENGINEERED PACKINGS"

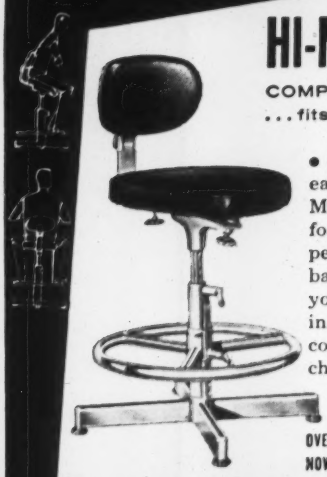
LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA

IF YOU SIT HIGH, YOU'LL "SIT HANDSOME" IN A *Cramer*

HI-MODEL CHAIR

COMPLETELY ADJUSTABLE ... fits YOUR build just right



• Scientifically planned in each detail, the Cramer Hi-Model has thick shaped-foam cushions and independently-adjustable seat, back and footring to support you comfortably and aid you in your work. Removable covers available in a wide choice of colors and fabrics.

OVER 100,000 CRAMER HI-MODEL CHAIRS NOW IN USE ALL AROUND THE WORLD!

Cramer Hi-Model 4D-22T, pictured, with forward-tilt seat; others available, all low-gravity balanced for use ON CASTERS if desired.

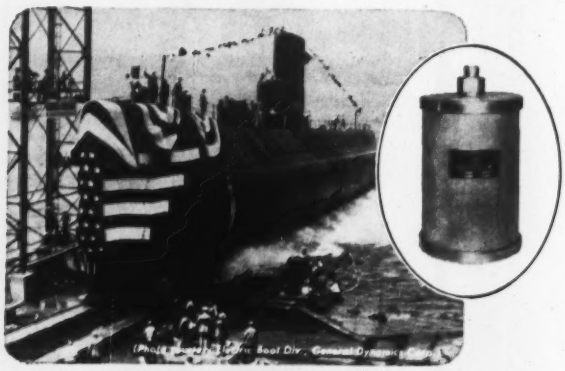
LIKE MORE INFORMATION?

Cramer Posture Chair Co. Inc., ME17
1205 Charlotte, Kansas City 6, Mo.
Please send complete facts on Cramer Hi-Model chairs for working architects and engineers.

Name_____

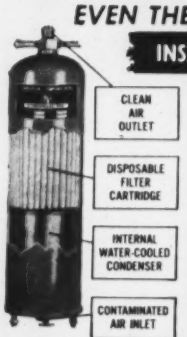
Firm_____

Address_____



EVEN THE "SEAWOLF" NEEDS....

INSTRUMENT-QUALITY COMPRESSED AIR



Moisture-free, Oil-free, Dirt-free...that's Instrument-Quality compressed air from a Hankison Condensifilter. Model B-30 DCNS (above) was built especially for use in the atomic submarine, "SEAWOLF." The unit provides Instrument-Quality compressed air for the ship's pneumatic control system.

HERE IS YOUR ANSWER TO COMPRESSED AIR PROBLEMS

Wherever dependable instrument and control service is needed, Condensifilters are specified. Write today for Bulletin M-7155R.

HC-8

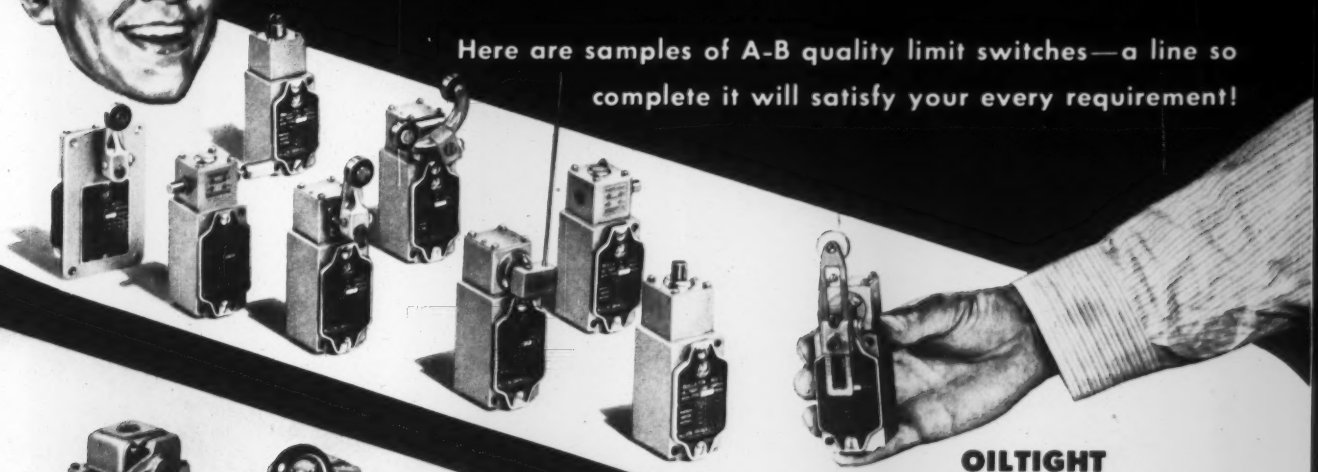
HANKISON CORPORATION

Biltmore Building • Pittsburgh 16, Pa.

Need a Limit Switch?

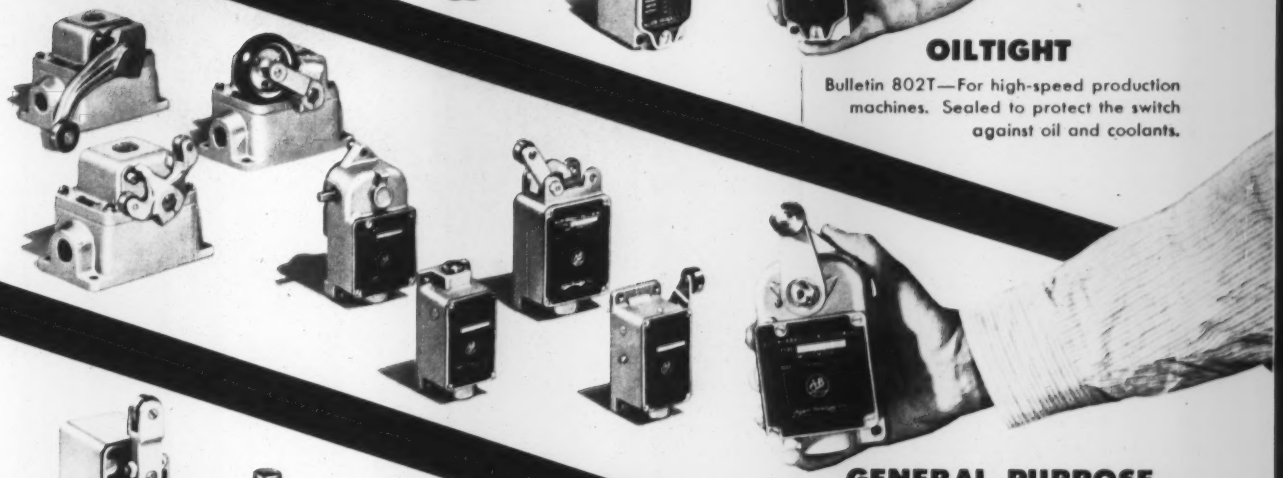
WHAT'LL YOU HAVE?

Here are samples of A-B quality limit switches—a line so complete it will satisfy your every requirement!



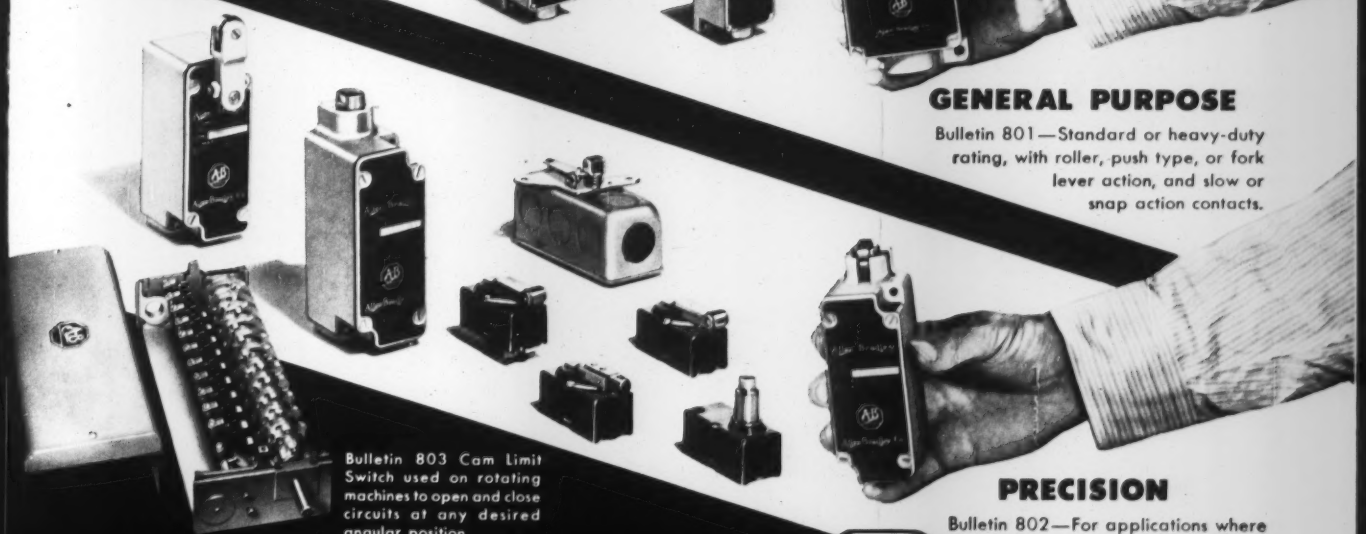
OILTIGHT

Bulletin 802T—For high-speed production machines. Sealed to protect the switch against oil and coolants.



GENERAL PURPOSE

Bulletin 801—Standard or heavy-duty rating, with roller, push type, or fork lever action, and slow or snap action contacts.



Bulletin 803 Cam Limit Switch used on rotating machines to open and close circuits at any desired angular position.

PRECISION

Bulletin 802—For applications where mounting space is small and operating motion is measured in thousandths of an inch.

1-57-MR

ALLEN-BRADLEY

QUALITY

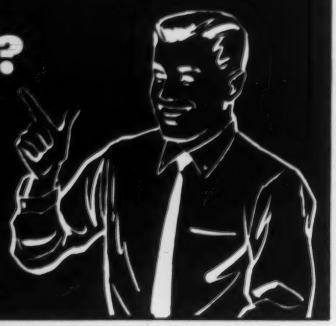
MOTOR CONTROL

A-B Quality

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

PILOT CONTROLS?

Yes...Allen-Bradley covers the field!



No matter what your needs for pilot control devices may be . . . refer to the new Allen-Bradley "handy" catalog . . . you will usually find what you are looking for. If not, please write Milwaukee, or contact your nearest Allen-Bradley representative.

All pilot controls are made to Allen-Bradley standards of quality. All of them have silver alloy contacts that require no service attention. You'll find it saves service time and money to specify Allen-Bradley.

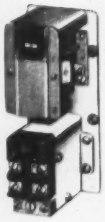
PHASE FAILURE AND PHASE REVERSAL RELAYS
BULLETIN 812
Style A disconnects motor if one phase of power circuit fails. Style B protects against phase reversal, as well.

OILTIGHT PUSH BUTTON STATIONS
BULLETIN 800T
For machine tool applications, to keep oil away from the contacts. Available in flush, surface, or pendant mounting.

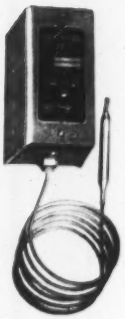
PRESSURE CONTROLS
BULLETIN 836
For noncorrosive liquids, vapors, gases, from 30 in. of vacuum to 700 psi. Accurate, rugged, compact, and attractive appearing.

PLUGGING SWITCHES
BULLETIN 808P
Used with a simple reversing switch, it provides quick, automatic stopping of machines driven by squirrel cage motors.

TIMING RELAYS
BULLETIN 849
A reliable and accurate pneumatic timer with a range of 1/6 to 180 seconds. Many arrangements. Motor driven, electronic and oil dashpot timers also available.

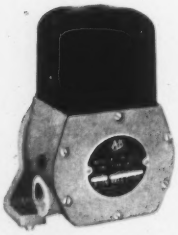


TEMPERATURE CONTROLS
BULLETIN 837
For temperatures from −45°F to 440°F. Metal bellows operates snap action precision switch with pure silver contacts.

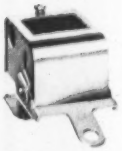


FOOT SWITCHES
BULLETIN 805
For operating punch presses, riveting, welding, and many other machines. Switch has snap acting, normally open and normally closed silver alloy contacts.

ZERO SPEED SWITCHES
BULLETIN 808
A plugging switch that brings squirrel cage motors to zero speed quickly, without any reversal of direction.

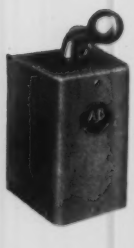


FLOAT SWITCHES
BULLETIN 840
Provide automatic control for motors operating tank or sump pumps.



PRESSURE SWITCHES
BULLETIN 830
For domestic water pumps, and commercial and industrial air compressors.

ROTARY SWITCHES
BULLETIN 806
Cam operated switches for the selection or transfer of various control circuits. Silver alloy contacts.



A-B Quality

ALLEN-BRADLEY

MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

Send for the new 7th Edition of the Allen-Bradley Handy Catalog. It is a veritable encyclopedia of reliable motor control.

1-57-MR

Here's why Wrought Iron Pipe serves longer at lower cost-per-year

Wrought iron pipe's longer life comes from its unique composition and structure. It is a two-component metal . . . high purity iron and glasslike iron silicate. The iron silicate is distributed throughout the iron in the form of threads or fibers. There are more than 250,000 fibers per sectional square inch.

These same fibers, illustrated in the magnified section above, give wrought iron its built-in protection against corrosion. When corrosion attacks, the network of these defensive fibers quickly arrests pitting and rapid penetration. As a result, corrosion is forced to spread out over the entire surface instead of penetrating the pipe wall, as happens in other materials. This effective safeguard against corrosion means that wrought iron pipe lasts longer at lower cost-per-year.

Service records in a variety of installations support this longer-life reputation of wrought iron pipe. Some of the applications where wrought iron is serving and saving are: heating system piping; air conditioning and refrigeration piping; water supply piping; sanitary system piping; sewage plant services; electrical conduit.

More of this story, and why you can use wrought iron pipe with confidence, is told in our booklet, *The ABC's of Wrought Iron*. Write for your copy today.

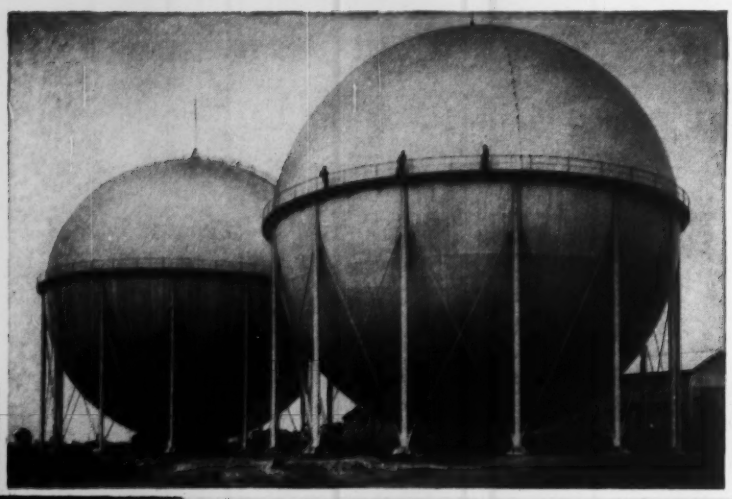
A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N.Y.

Available in Canada and throughout the world.

BYERS *Wrought Iron Tubular and Hot Rolled Products*

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

3.4 Million Pounds of Steel Saved



HIGH WORKING STRESS. These vessels are of Chicago Bridge & Iron Company's Hortonsphere construction. They were designed for storing natural gas at a pressure of 71.1 psi in Tokyo, Japan . . . with an earthquake factor of 0.30 and wind pressure of 26 lbs. per sq. ft. on the projected spherical area. USS "T-1" Steel vessels were built to a maximum allowable working stress of 36,000 psi with 90% weld joint efficiency. This stress is about one-third of USS "T-1" Steel's ultimate tensile strength. Each vessel is supported by 14 tubular columns, 18 inches in diameter. The top portion of each column, which is welded to the sphere, is made of USS "T-1" Steel. The columns rest on 14 concrete piers which are interconnected by reinforced concrete struts. Chicago Bridge & Iron Company is now fabricating steel for two additional, slightly smaller vessels of similar construction for Tokyo Gas Works, Ltd.

in Two Giant Pressure Vessels by using USS "T-1" STEEL!

Six conventional pressure vessels would have been required to provide the same capacity, under the same pressure, as these two natural-gas storage tanks made from USS "T-1" Steel.

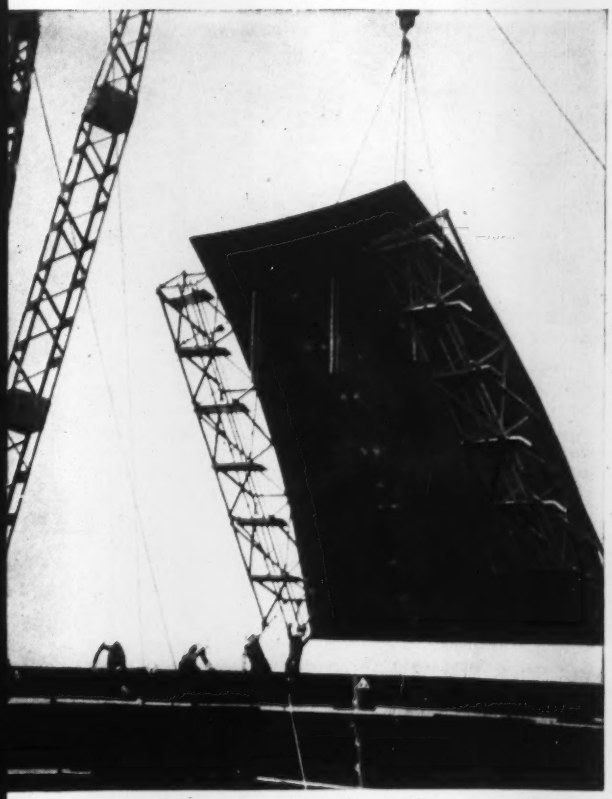
The six conventional vessels would be built with structural carbon steel which has a yield strength only one-third as great as USS "T-1" Steel. As a result, the maximum size of each vessel would be restricted . . . the shell walls would have to be thicker . . . and the six vessels, together, would weigh nearly 2½ times as much as the two vessels that were actually built with USS "T-1" Steel.

The six conventional vessels, being heavier, would have required more foundation material and supports . . . would have been more expensive to ship, to handle, to erect . . . and would have occupied much more ground area.

USS "T-1" Steel—with a yield strength of 90,000 psi—was the only existing steel from which the two large vessels could have been built economically. Structural carbon steel is not strong enough. High alloy steels are not easy to weld—and they cost more than USS "T-1" Steel. USS "T-1" Steel has *both* the extra strength and the excellent weldability that are needed.

These two vessels were built for Tokyo Gas Works, Ltd., Tokyo, Japan, under the supervision of erection engineers of Chicago Bridge & Iron Company. Chicago Bridge & Iron also designed the vessels and fabricated the steel.

NEW BOOKLET AVAILABLE! Our new revised booklet on USS "T-1" Steel gives you complete facts about the application of this remarkable steel. Much new information has been added on welding and fabrication, and all other information has been brought up to date. If you design steel structures, you need this booklet. Write, today, for a free copy. Or get in touch with the nearest USS Sales Office. United States Steel, Room 2801, Pittsburgh 30, Pennsylvania.



FIELD WELDING. Each vessel contains 188 separate USS "T-1" Steel plates (Quenched and Tempered, Firebox Quality), 0.73-inch thick, which were welded in the field with E12016 electrodes. All welds were 100% X-Rayed. The steel was fabricated by Chicago Bridge & Iron Company in Greenville, Pennsylvania. All fittings—including two 16-inch nozzles, two 20-inch manways and many smaller nozzles—were forged from USS "T-1" Steel billets.

A COMPARISON of two typical methods of constructing these Japanese pressure vessels: one, with USS "T-1" Steel, and the other, with structural carbon steel, is shown in the following chart, courtesy of Chicago Bridge & Iron.

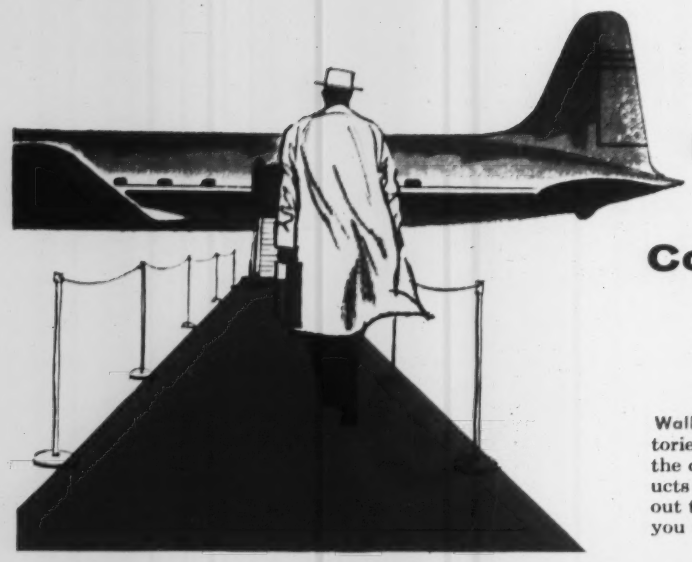
	USS "T-1" Steel Full X-Ray Required	Structural Carbon Steel Full X-Ray 90% Joint
Pressure	71.1	71.1
Stress (psi)	32,400	13,500
Diameter (Ft.)	110.5	79.17
Wall Thickness (In.)	.73	1.25
Geometric Volume (Cu. Ft.)	707,000	260,000
Weight (Each Vessel) Tons	625	545
Number Of Vessels Required To Provide 1,414,000 Cu. Ft. Geometric Cap.		5.45
Total Weight Tons (All Vessels)	1,250	2,970
Weight Saving Using "T-1" Steel (Million Pounds)	3.44	

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

USS

UNITED STATES STEEL CORPORATION, PITTSBURGH - COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

UNITED STATES STEEL



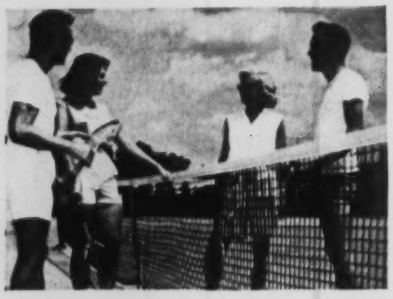
OPPORTUNITY keynotes your career in the IBM Airborne Computer Laboratories

Walk the red carpet to IBM's Airborne Computer Laboratories in Owego, New York, to see for yourself, first-hand, the challenging *opportunities* available in Military Products engineering. Talk with the men who are now carrying out these advanced projects and let their enthusiasm stir you to join our ranks.

Opportunity in Engineering: High-speed electronic computers, both digital and analog types, are developed within the ACL to fit specific Air Force requirements. As an ACL engineer, you will find ample *opportunity* to put your talents to work in a variety of assignments.

Opportunity to learn: If you believe *knowledge is your greatest security*, ACL offers *opportunities* to obtain advanced degrees, attend seminars, training courses; to consult with renowned experts and to prepare yourself for greater responsibility.

Opportunity for adventure: IBM Flight Test engineers fly with the Air Force in B-47 and B-52 aircraft, checking the dynamic operation of our airborne equipment. Field Engineers work on the flight line, maintaining operating production systems.



Opportunity for better living: Ideally located Owego, close to the Finger Lakes, offers you and your family every *opportunity* for recreation and pleasant living. The IBM C.C. (725 acres) offers diverse recreational facilities for the family, including swimming pools, two golf courses, rifle range, bowling, etc.

For more information, write, outlining background and experience, to: R. A. Whitehorne, Room 501, International Business Machines Corporation, 590 Madison Avenue, New York 22, New York.

Exceptional career opportunities are now open at the IBM Airborne Computer Laboratories for E.E.'s, M.E.'s, physicists, and mathematicians, in the following fields:

Digital and Analog Systems	**Reliability**	**Power Supplies**
Inertial Guidance	**Components**	**Transistors**
Servo-Mechanisms	**Physics**	**Heat Transfer**
Electronics	**Mathematics**	**Optics**
Mechanical Design	**Human Factors**	**Test Equipment**
Packaging	**Installation**	**Cost Estimating**

Tremendous job flexibility enables ACL to custom-fit the engineer to the job. ACL offers you small-company advantages with large-corporation security. IBM's salaries are excellent; company benefits tops for industry. The rate of turnover at IBM is less than 1/6 the national average.

MILITARY PRODUCTS
DATA PROCESSING
ELECTRIC TYPEWRITERS
TIME EQUIPMENT

IBM MILITARY PRODUCTS

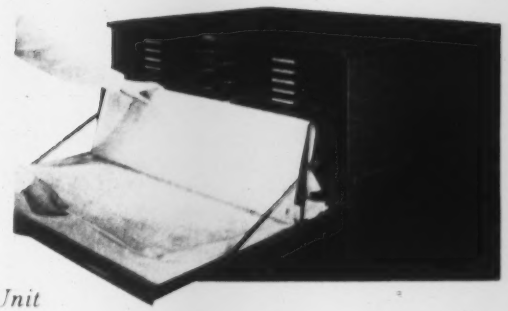
You'll get more work done...

Auto-Shift Table

The man at the Auto-Shift produces more. Two finger-tip controls adjust board height and slope so easily that working position can be frequently changed—board can be instantly, effortlessly shifted to most convenient and comfortable position. Work is shifted to draftsman—draftsman never reaches for work.

and handle it better...with

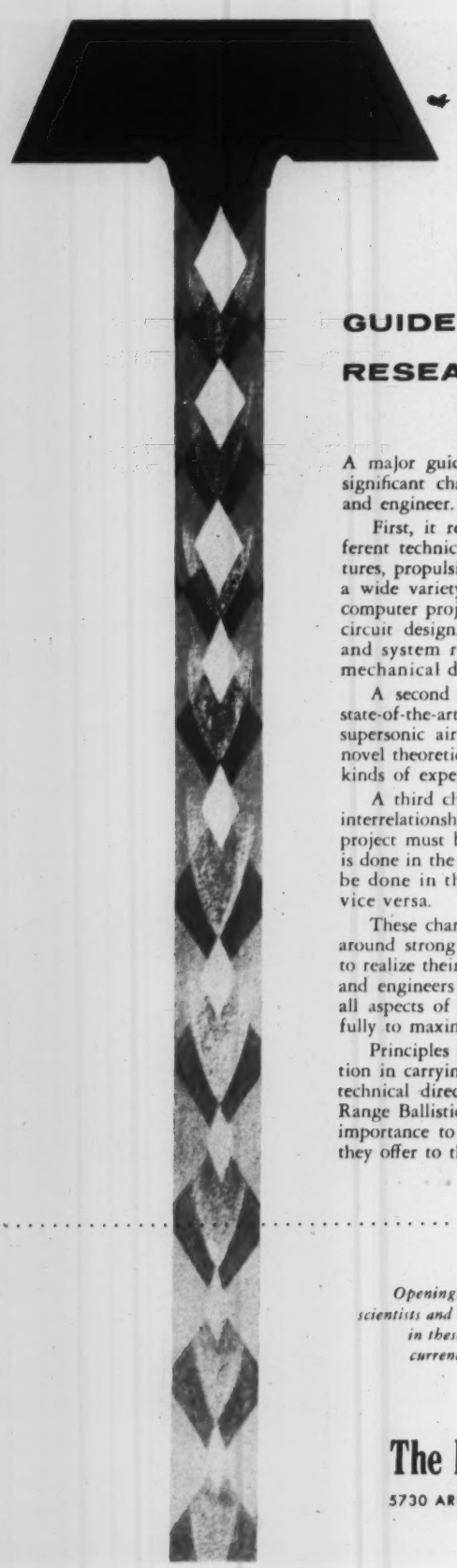
The tracing you want is *always on top* in a Hamilton Shallow-Drawer unit. An exclusive Hamilton *tracing lifter* supports all tracings filed above—permits any one tracing to be easily located, removed or refiled. When drawer is closed, same *tracing lifter* compresses all sheets—keeps them flat and wrinkle-free



Shallow-Drawer Unit

Hamilton Drafting Equipment

HAMILTON MANUFACTURING COMPANY • TWO RIVERS WISCONSIN



GUIDED MISSILE
RESEARCH and DEVELOPMENT

A major guided missile research and development program has several significant characteristics that are of particular interest to the scientist and engineer.

First, it requires concurrent development work in a number of different technical areas such as guidance and control, aerodynamics, structures, propulsion and warhead. Each of these large areas in turn contains a wide variety of specialized technical activities. As an example, digital computer projects in the guidance and control area involve logical design, circuit design, programming, data conversion and handling, component and system reliability, input-output design, and environmental and mechanical design.

A second characteristic is frequently the requirement for important state-of-the-art advances in several of the technical areas. For instance, the supersonic airframe needed for a new missile may necessitate not only novel theoretical calculations, but also the design and performance of new kinds of experiments.

A third characteristic of missile development work is that such close interrelationships exist among the various technical areas that the entire project must be treated as a single, indivisible entity. For example, what is done in the guidance portion of the system can affect directly what must be done in the propulsion and airframe portions of the system, and vice versa.

These characteristics make it clear why such work must be organized around strong teams of scientists and engineers. Further, for such teams to realize their full potential, they must be headed by competent scientists and engineers to provide the proper technical management. And finally, all aspects of the organization and its procedures must be tailored carefully to maximize the effectiveness of the technical people.

Principles such as these have guided The Ramo-Wooldridge Corporation in carrying out its responsibility for overall systems engineering and technical direction for the Air Force Intercontinental and Intermediate Range Ballistic Missiles. These major programs are characterized by their importance to the national welfare and by the high degree of challenge they offer to the qualified engineer and scientist.

Openings exist for scientists and engineers in these fields of current activity:

Guided Missile Research and Development
Aerodynamics and Propulsion Systems
Communications Systems
Automation and Data Processing
Digital Computers and Control Systems
Airborne Electronic and Control Systems

The Ramo-Wooldridge Corporation

5730 ARBOR VITAE STREET • LOS ANGELES 45, CALIFORNIA

Opportunities

positions open • positions wanted • equipment, material, patents, books, instruments, etc. wanted and for sale • representatives • sales agencies • business for sale • partnership • capital • manufacturing facilities

ANSWERS to box number advertisements should be addressed to given box number, care of "Mechanical Engineering," 29 West 39th St., New York 18, N. Y.

RATES: Classified advertisements under this heading in MECHANICAL ENGINEERING are inserted at the rate of $1.70 a line. $1.35 a line to members of ASME. Seven words to the line average. A box number address counts as one line. Minimum insertion charge, 5 line basis. Display advertisements carried in single column units of multiples of one inch at flat rate of $28 per inch per insertion. Copy must reach us not later than the 10th of the month preceding date of publication.

POSITIONS OPEN

ENGINEER MECHANICAL

Development Dept. in large N.J. pharmaceutical plant has an excellent opportunity for a young, ambitious engineer with a well rounded background of layout and installation of plant equipment. Field construction and equipment cost estimating experience desirable. Liberal benefit program. Please submit complete resume including salary requirements.

Address CA-6041, % "Mechanical Engineering"

MECHANICAL ENGINEER

Long established company requires a graduate engineer, preferably with rolling mill experience. New position involves responsibility for improvements to present equipment and development of new facilities.

Salary will be commensurate with experience and ability. Excellent working conditions.

Reply, giving personal data, complete experience record and salary desired.

FAIRMONT ALUMINUM COMPANY
Subsidiary of Cerro de Pasco Corporation
Fairmont, West Virginia

SYLVANIA'S
Electronic Defense Laboratory
(Located in the San Francisco Bay Region)
NEEDS
mechanical engineers

Preferably with experience in military and electronic equipment.

Sylvania offers the finest facilities and equipment available. We also provide financial support for advanced education, as well as a liberal insurance, pension and medical program.

Our laboratory is located five miles from Palo Alto in the San Francisco Bay area, close to excellent schools and universities, unexcelled living conditions, ideal climate and ample housing.

RELOCATION EXPENSES PAID.

Please send complete resume to:

John C. Richards
Electronic Defense Laboratory
Box 205, Mountain View, Calif.

SYLVANIA
SYLVANIA ELECTRIC PRODUCTS INC.

INDUSTRIAL ENGINEERS
$6000–$8000

Excellent opportunities for men with M.E. or I.E. degrees with a multi-plant company where advanced materials handling, plant layout, standards and methods are practiced. Employer pays our fee and expenses. Send resume and photo to Mr. H. A. Jensen

WALKER EMPLOYMENT SERVICE
212 So. 7th St. Minneapolis 2, Minn.

HOW TO BE THE HAPPIEST CREATIVE ENGINEER IN CALIFORNIA

Engineers (E.E., M.E., Mfg., Sales) can have the kinds of jobs that creative men dream about. Top salaries and benefits. Suburban locations in Fullerton, Newport Beach, Richmond, or Palo Alto.

Write Beckman Instruments, Inc., 2999 W. 6th Street Los Angeles 5, California. Ask for Career File 55-1.

MECHANICAL ENGINEERS
A Career With . . . *Linde*
IN LIQUID NITROGEN

Unusual and challenging career openings are offered in liquid nitrogen APPLICATION DEVELOPMENT

- **indefinite preservation and processing of biological materials.**
- **design of liquid nitrogen vacuum insulated containers.**
- **application of extreme pressures and low temperature.**
- **application of liquid nitrogen temperature in the shipment of frozen foods without intransit refrigeration.**

The magnitude and diversity of LINDE products and processes are appealing to Mechanical Engineers who are seeking employment with a dynamic company of proven stability

Bachelors or Masters are invited to investigate.

LINDE AIR PRODUCTS COMPANY
a division of
UNION CARBIDE AND CARBON CORPORATION
Send resume to: Mr. R. P. Kalle
P. O. Box 44, Tonawanda, New York
Refer to ad: ME-N

MECHANICAL ENGINEERS...
You'll find professional stimulation in
RCA's AIRBORNE WEAPONS SYSTEMS Projects!

As a mechanical or aeronautical design engineer, you can now grow with RCA's creative engineers on airborne weapons systems. In addition to your bachelor or advanced degree, you should have experience in design of aircraft structure and mechanisms or design of aircraft control instruments.

These RCA problems call for truly advanced effort. You will be challenged by the severe environmental conditions encountered in the supersonic flight of tomorrow's highest-speed aircraft. New concepts in mechanical design are required to deal with previously unexplored states of temperature, altitude, shock, vibration and humidity.

Plus . . . completely equipped engineering laboratories—advancement on merit—full benefits program—relocation expenses paid.

Please send resume of education and experience to:

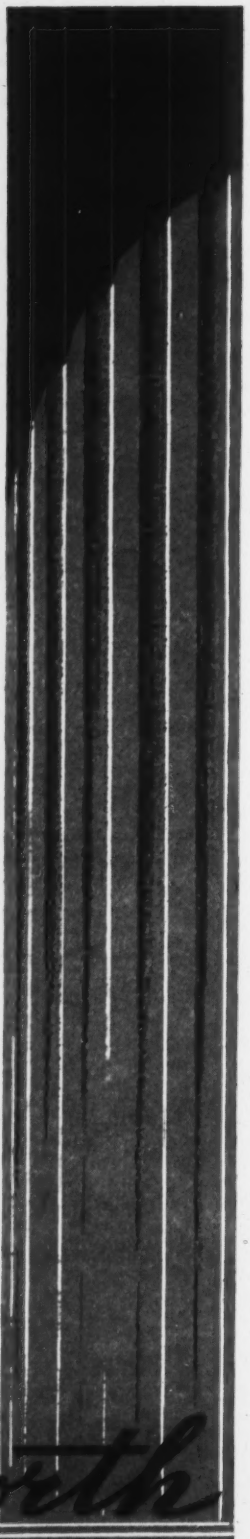
Mr. John R. Weld, Employment Manager
Dept. Z-11A Radio Corporation of America
Camden 2, N. J.

RCA RADIO CORPORATION OF AMERICA
DEFENSE ELECTRONIC PRODUCTS

engineers *and* **physicists** *seeking* **stability**

. . . find it at Farnsworth,
the newest electronics division
of International Telephone
and Telegraph Corporation
. . . the world's most
extensive combined research,
development,
manufacturing and
operating organization in
telecommunications
and electronics.
Combine the advantages of
"large company"
stability and technical
perspective with Farnsworth's
"small company"
flexibility, growth,
and recognition of the individual
and you have
the ideal situation that
warrants investigation.
Your resume
will receive prompt,
confidential attention.

Address:
Technical Employment Director
FARNSWORTH ELECTRONICS COMPANY
FORT WAYNE, INDIANA



Farnsworth

A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

FARNSWORTH ELECTRONICS — A DIVISION OF I T & T

MECHANICAL ENGINEER

Graduate mechanical engineer in power plant design work. Experience not required. Excellent opportunity with consulting engineering firm in the Middle West. Liberal benefit plans and good working conditions.

Send resume of education and experience with statement of salary requirements.

Address CA-5905, % "Mechanical Engineering."

MECHANICAL ENGINEER

This message is intended to appeal to an engineer who can thoroughly enjoy the hard work, diversification, and multiple responsibilities associated with small company growth. Our expansion over the past few years has been phenomenal; sales have tripled, net worth doubled. "Opportunity" is a hackneyed, often empty word; with us, it is a way of life.

The company is an aggressive, expansion minded manufacturer of light construction and farm equipment. We seek engineering talent with the imagination and fortitude to help carry our tradition of growth and progress. Salary is open and is secondary to finding the right man. Initial duties and responsibilities will depend on qualifications of the individual. The job will involve hard work, and the freedom to create, invent, and *grow*.

If you would like to explore this possibility, please write to

J. Lendrum, Master Vibrator Company, 1752 Stanley Avenue, Dayton, Ohio.

ENGINEERS

OPPORTUNITIES

AT

B-U-L-O-V-A

Famous for Precision Manufacturing

- **PROJECT ENGINEERS**
- **DESIGN ENGINEERS**

High-volume production of small precision electro-mechanical devices, such as micro-relays, shavers, motion-picture cameras, missile components, and fractional H.P. motors.

Compensation commensurate with experience, and liberal employee benefits, including special aids to education.

Telephone for appointment, or submit confidential resume to

BULOVA WATCH COMPANY, INC.

Bulova Park, Flushing 70, N. Y.
Att: MR. DAVID A. BROWN
DEfender 5-6000

SENIOR METALLURGICAL ENGINEER

3-5 years metallurgical experience desired to specialize in casting and forging design consultation and procurement assistance; establish radiographic, ultrasonic and metallurgical requirements. Professional degree in applicable field required.

SENIOR PRODUCIBILITY ENGINEER

4-8 years aircraft or similar producibility experience desired in addition to applicable technical schooling to conduct and co-ordinate production engineering methods analysis and cost evaluations for development and design proposals and products.

SENIOR WEIGHTS ENGINEER

4-6 years experience in addition to Civil, Aeronautical or Mechanical Engineering or Physics degree for responsibilities in preliminary design, weight control, and weight methods groups.

GROUP ENGINEER

Structures

8 years minimum stress analysis, structural loads and criteria experience desired to direct stress analysis and structural methods groups on prime airframe and missile projects.

GROUP ENGINEER

Propulsion

8-10 years experience in power plant design group of prime manufacturer of military aircraft. Must be capable of directing design of power plant installation, heating and ventilating system installation, and fuel system installation.

TEMCO

AIRCRAFT CORPORATION • DALLAS

IN ENGINEERING, THE BEST OPPORTUNITIES ARE IN AVIATION

IN AVIATION THE BEST OPPORTUNITIES ARE AT TEMCO

MR. J. RUSSELL, *Engineering Personnel*
Dept. 170-C, Temco Aircraft Corporation
Box 6191, Dallas, Texas

Please send me complete details of the Temco story of unusual opportunities for creative engineers. I am especially interested in _____

Name _____

Address _____

City _____ *State* _____

Senior Research Scientist for Fundamental Studies of Interior Ballistics of solid propellant rocket engines

A challenging position is now open for a man of broad, fundamental background capable of original experimental and theoretical studies, who desires to contribute significantly to the nation's missile program.

The range of individual initiative is practically unlimited; the climate, beauty and living conditions of historic Sacramento completely satisfying.

Aerojet-General CORPORATION

A Subsidiary of The General Tire & Rubber Company — THE GENERAL TIRE — PLANTS AT AZUSA AND NEAR SACRAMENTO, CALIFORNIA

For further information regarding this unique opportunity, write:
Dr. James H. Wiegand, Head
Solid Engine Research Dept.
Aerojet-General Corp.
Box 1947 BB, Sacramento, Calif.

WINCHESTER
TRADE MARK

World-Famous Firearms

An extensive modernization program has resulted in openings for several engineers at all experience levels in

PROCESS ENGINEERING
RESEARCH and DEVELOPMENT

Recent graduates as well as those experienced in metals machining, tolerance studies and finishing; woodworking; metallurgy and hot working of steel; should contact the

Employment Manager
Winchester-Western Division
OLIN MATHIESON CHEMICAL CORPORATION
New Haven, Connecticut

CHALLENGING OPPORTUNITIES IN RESEARCH AND DEVELOPMENT

for

FLUID MECHANICS ENGINEERS

Engineers of advanced standing will find challenging work at the Garfield Thomas Water Tunnel of the Ordnance Research Laboratory located at The Pennsylvania State University. This laboratory is engaged in basic and applied research in the field of underwater propulsion and related subjects, including cavitation, hydroelasticity, and hydrodynamic control of submerged bodies. The existing openings offer opportunities for combining research and development work in these fields with various academic activities.

MECHANICAL ENGINEERS

Mechanical engineers with research ability and experience in missile development.

University faculty appointments

Opportunities for graduate study.

Liberal vacation allowances.

Security benefit programs.

Send Resume to:
ARNOLD ADDISON, *Personnel Director*
THE PENNSYLVANIA STATE UNIVERSITY
ORDNANCE RESEARCH LABORATORY
University Park **Pennsylvania**

DU PONT NOW OFFERS

SIX CAREER POSITIONS OF CHALLENGE AND RESPONSIBILITY IN SPECIALIZED AREAS OF MECHANICAL ENGINEERING

The Engineering Service Division of du Pont's Engineering Department provides consulting service and technical assistance to production, maintenance, design, research, and construction groups within the company. The Division's objectives are to assist other company units in improving plant efficiency and product quality, in reducing investment and operating costs, and in increasing capacity.

Six openings are immediately available for experienced graduate engineers to provide consulting service to operating plants in the following specialized mechanical engineering fields:

DRYING AND DRYING EQUIPMENT

Desired qualifications will include substantial experience in the practical aspects of drying particulate solids and sheet and fibrous materials. A sound knowledge of the fundamentals of heat and mass transfer is important. The duties of the position will require a broad and detailed knowledge of mechanical drying equipment and their applications. The position requires a high level of creativeness and skill in evolving unorthodox solutions to practical problems in drying.

INSTRUMENT MAINTENANCE

Successful applicant will have had extensive experience in the installation, application, and maintenance of chemical process instrumentation. Duties include: setting up or modernizing plant maintenance forces for proper care of electronic, pneumatic, and hydraulic controls and instrumentation; making cost studies; planning and organizing training programs for maintenance personnel; instituting effective preventive maintenance programs; development of standard procedures for instrument calibration and maintenance; and assistance in establishing efficient installation methods and in start-up of new facilities.

HEAT TRANSFER

Duties include: trouble-shooting on equipment, such as pipe line reactors, fluidized solids reactors, and film driers, where heat transfer is one controlling factor; selection of equipment, such as heat exchangers, evaporators, furnaces, and driers; evaluation of equipment to determine optimum alternatives; and theoretical analysis of problems in heat transfer in proposed equipment for new applications. Other typical heat transfer problems encountered involve reboilers, inert gas generators, direct fired production furnaces, and indirect fired retorts.

COMPUTER PROGRAMMER

Position requires an educational background combining an extensive program of study in engineering with heavy emphasis on mathematics or applied statistics.

The successful applicant will be assigned to a new company-wide Operations Analysis Group, the activities of which include: programming electronic computers; mathematical formulation of scientific problems and a broad variety of business and management problems; and applied statistics, such as process analysis, quality control, and the design and analysis of experiments.

CORRECTIVE MAINTENANCE

Duties will require substantial experience in solving equipment maintenance problems such as selection and application of lubricants and the installation and maintenance of lubricating facilities; power transmission equipment maintenance and vibration and stress analysis; selection of materials for proper applications of packing and gaskets, including installation techniques and failure review; techniques of application of protective coatings and surface preparations; welding, metal working, and related shop practices; and bearing and mechanical seal applications.

POWER

Position requires extensive practical power experience, including operation and maintenance of industrial steam power plant facilities and equipment testing. Some experience in steam plant design and construction or in thermal insulation of process piping and equipment is desirable. Duties include: making economic evaluations and involved heat balances for complicated power systems; assisting in specification of power equipment and in selection of new facilities; and determination of causes of equipment malfunctioning and development of recommendations for corrections.

CLEVELAND INTERVIEWS
Sun-Mon-Tues-Wed
January 27-28-29-30

To arrange an appointment with our technical representative, please call
Mr. K. S. Marlin, Jr. PRospect 1-6857

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Or you may send complete resume, including details of education and experience, to:

Mr. K. S. Marlin, Jr., Engineering Department

E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Delaware

ENGINEERS . . . PHYSICISTS

NEW opportunities at MOTOROLA

YOUR CHOICE OF 3 LOCATIONS

New Motorola research laboratories are expanding, creating outstanding career advantages—your opportunity to get in on the ground floor of a swiftly expanding company. You'll enjoy working in these modern laboratories . . . with liberal employee benefits, including an attractive profit sharing plan. Salary levels are open and commensurate with ability.

POSITIONS AVAILABLE IN: two-way communications • missile electronics • radio & TV (color) • weapons systems • computer application & design • transistor research & production • microwave systems • servo-mechanisms • physical chemistry • metallurgical eng. • field eng. • electronic sales eng. • drafting, design, & layout • aerophysics • radar & military electronics

PHOENIX, ARIZONA

Outdoor, relaxed living the year-round, with lots of room to grow (on the job and off) in this land of sunshine.

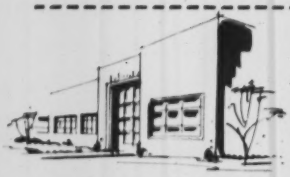
RESEARCH LABORATORY
write to: Mr. R. Coulter, Dept. E, 3102 N. 56th St., Phoenix, Ariz.

SEMI-CONDUCTOR LABORATORY
write to: Mr. V. Sorenson, Dept. E,
5005 E. McDowell Rd., Phoenix, Ariz.

RIVERSIDE, CALIFORNIA

Planned communities, modern shopping centers, advanced schools, fine buys in homes. There's room to grow and more fun in Riverside.

write to: Mr. C. Koziol, Dept. E, Box 2072, Riverside, Calif.



CHICAGO, ILLINOIS

Live a relaxed midwest life in one of the beautiful suburbs, yet have all the "big city" advantages—cultural, social, and educational.

write to: Mr. L. B. Wrenn, Dept. E,
4501 Augusta Blvd., Chicago, Ill.

MOTOROLA

Flight Loads Engineers

for Republic Aviation
Long Island, N. Y.

A large increase in the number of models reaching the flight test phase of development and an increased emphasis on the measurement of flight loads has created some unusual ground floor opportunities in this field.

(1) Flight load engineers at Republic are given a wide scope of action. You will not find the over-specialized restrictive organization so prevalent at the other companies.

(2) Initiative is placed at a premium giving the engineer a true sense of accomplishment.

(3) No other field will give you a more diversified experience. You will deal with aerodynamics, structures, systems and instrumentation.

(4) The planned continuing expansion of the department affords excellent means for advancement.

If you have experience in any or all of the following fields, Republic can offer you wonderful opportunities plus happy living on Long Island.

Instrumentation Design for Flight Loads Programs

•

Strain Gage Installation and Calibration

•

Calibration, Data Reduction and Bridge Combining

If you want to work on the broad aspect of aircraft engineering and have experience in flight loads, basic loads, stress analysis or instrumentation, investigate these opportunities now.

Employment advantages at Republic Aviation include company-paid hospitalization insurance, surgical insurance, accident and life insurance, tuition (⅗), 2-fold pension plan, individual merit rated increases and many other benefits.

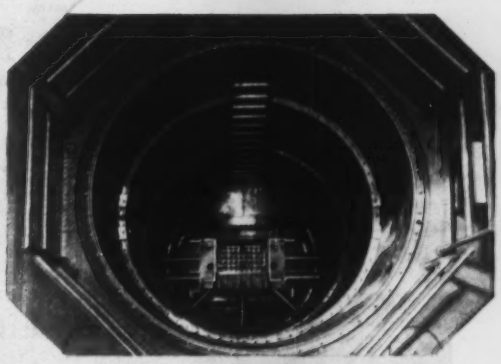
Please send your resume including details of technical background to:

Mr. David G. Reid
Engineering Personnel Manager

REPUBLIC AVIATION
Farmingdale, L. I., N. Y.

another example of exciting work at los alamos...

OMEGA WEST



Omega West, newest of the research reactors at Omega site in Los Alamos, is one of several reactors in operation or under development at the Laboratory. The OWR is designed for high flux at low cost, flexible operation, and has extremely versatile port facilities. This installation is an important addition to the impressive array of research facilities available to Los Alamos scientists.

The Laboratory is interested in receiving employment applications from engineers and scientists of superior qualifications. Direct your inquiry to:

Department of Scientific Personnel
Division 1607

Los Alamos Scientific Laboratory is a non-civil service operation of the University of California for the U. S. Atomic Energy Commission.

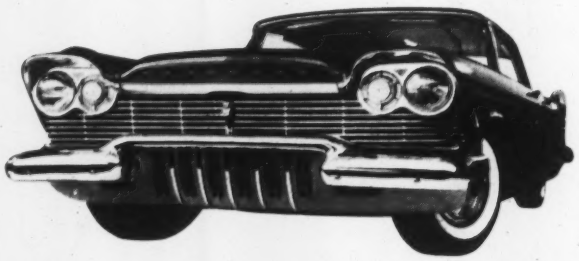
los alamos
scientific laboratory
OF THE UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

WHAT MOST ENGINEERS LOOK FOR, AT CHRYSLER ENGINEERING! YOU'LL FIND

As an engineer, you are essentially a creative person. That's why a "ho-hum" job is not for you. You like to do big things, to meet challenges head-on. You know your future depends on *you*, and you alone, and you want to earn it with your own hands.

We think you'll find here at Chrysler Engineering just what you've been looking for. Challenging work. Creative assignments. Flexibility and freedom in the work you do. The opportunity to make many of your own decisions. Good pay. Fellow employees and superiors who are easy to work with. The finest working conditions. Excellent advancement opportunities, including rewards for ambition and accomplishments. And the opportunity to increase your knowledge of technical matters by working with people who are authorities in the field.

Discover for yourself just what Chrysler Engineering has to offer. You have nothing to lose—*everything* to gain. Write Mr. L. C. Bettega, Engineering Division, Chrysler Corporation, Detroit, Mich., for full details on how you can become associated with the company that has "The Forward Look."



Suddenly, it's 1960! Here is a head-on look of the new 1957 Plymouth—the car that's years ahead of its field in beauty, performance and all-out value. Join the team that made this great car possible!

CHRYSLER Corporation
ENGINEERING Division
P.O. BOX 1118 • DETROIT 31, MICHIGAN

CHIEF ENGINEER

To direct the activities of a recently established Central Engineering Department for a multi-plant corrugated and folding box operation. A Mechanical Engineering degree is preferred and experience in the design and development of automatic machinery for the Box Manufacturing or Paper Converting fields is required. A background of close association with production problems and production personnel is also essential. The location will be in the East. Replies will receive prompt and confidential consideration.

Address CA-6025, % "Mechanical Engineering."

SALES ENGINEERS WANTED

Excellent opportunities for engineers with well established East Coast Industrial Manufacturer now expanding branch office coverage.

Electrical, Mechanical, or Electronic Engineers preferred.

Openings in Oregon, San Francisco, St. Louis, and Detroit.

Generous company paid benefits include hospitalization, pension, insurance, and vacation plans.

Address CA-5940, % "Mechanical Engineering."

ENGINEERING WITH ... *Linde*

- EQUIPMENT DESIGN
- FABRICATING TECHNIQUES
- INSTRUMENTATION AND CONTROLS
- THERMODYNAMICS AND HEAT TRANSFER
- PILOT PLANT DESIGN AND OPERATION
- PROCESS ENGINEERING
- STRESS ANALYSIS

We have excellent openings for Mechanical Engineers in projects associated with the production and distribution of oxygen, nitrogen and argon at low temperature liquids or gases.
LOCATION: Our Tonawanda Laboratories in suburban Buffalo, New York—LINDE'S largest research and development facilities.
B.S., M.S., Ph.D. graduates—send resume covering education (approximate academic achievement), experience and work interests to:

LINDE AIR PRODUCTS COMPANY
a division of
UNION CARBIDE AND CARBON CORPORATION
P. O. Box 44, Tonawanda, New York
Attention: Mr. R. P. Kalle
Refer to ad: ME-L

DESIGNERS

WHERE do you start training for promotion from your first day on the job?

For the answer, turn to page 155

A message to the *Career-Conscious Engineer:*

Ready to change jobs?

Perhaps you are not receiving a salary commensurate with your work.

Perhaps you are dissatisfied with your rate of promotion.

Perhaps you do not have enough scope for your ability in your present job.

Or perhaps you simply want to move to Southern California.

We invite you to consider the California Division of Lockheed Aircraft Corporation as the place to re-establish your career. For these reasons:

Promotional Opportunities are excellent because there are so many supervisory positions to be filled with 46 major projects in progress at Lockheed and because Lockheed is in an expanding development and production program.

You have more scope to show what you can do because Lockheed projects range across virtually the entire spectrum of aeronautical endeavor. You are not limited to one type of work because Lockheed is so diversified in projects. Moreover, Lockheed encourages and welcomes personal initiative.

You may receive a substantial increase in pay because Lockheed is extremely liberal in direct salary and in extra employee benefits, which actually increase the value of your position by an average of 14%. *Engineers' salaries have been raised 19% in the last three and one-half years.*

Positions are open at all levels for engineers in fields of: Aerodynamics – Design – Electronics, with emphasis on systems and antenna design – Flight Test Engineering, particularly in instrumentation – Math. Analysis – Operations Research – Structures – Thermodynamics – Weight.

Space prevents us from listing all the reasons we believe you will find significant. There are many others. But if our brief remarks make sense to you, write us and we can explore your opportunities at Lockheed through personal interview or phone. The brief resumé below is simply for your convenience in contacting us.

ADVANCED EDUCATION PROGRAM FOR ENGINEERS

You can expand your technical knowledge and achieve advanced degrees through a variety of Lockheed-sponsored university programs that cost you little or nothing.

TO ENGINEERS WHO LACK AIRCRAFT EXPERIENCE

Aircraft experience is not necessary to join Lockheed. It's your engineering training and experience that count. Lockheed trains you for aircraft engineering – at full pay.

Lockheed AIRCRAFT CORPORATION

California Division BURBANK **California**

E. W. Des Lauriers, Dept. CJ-4-1
Lockheed Aircraft Corporation
Burbank, California

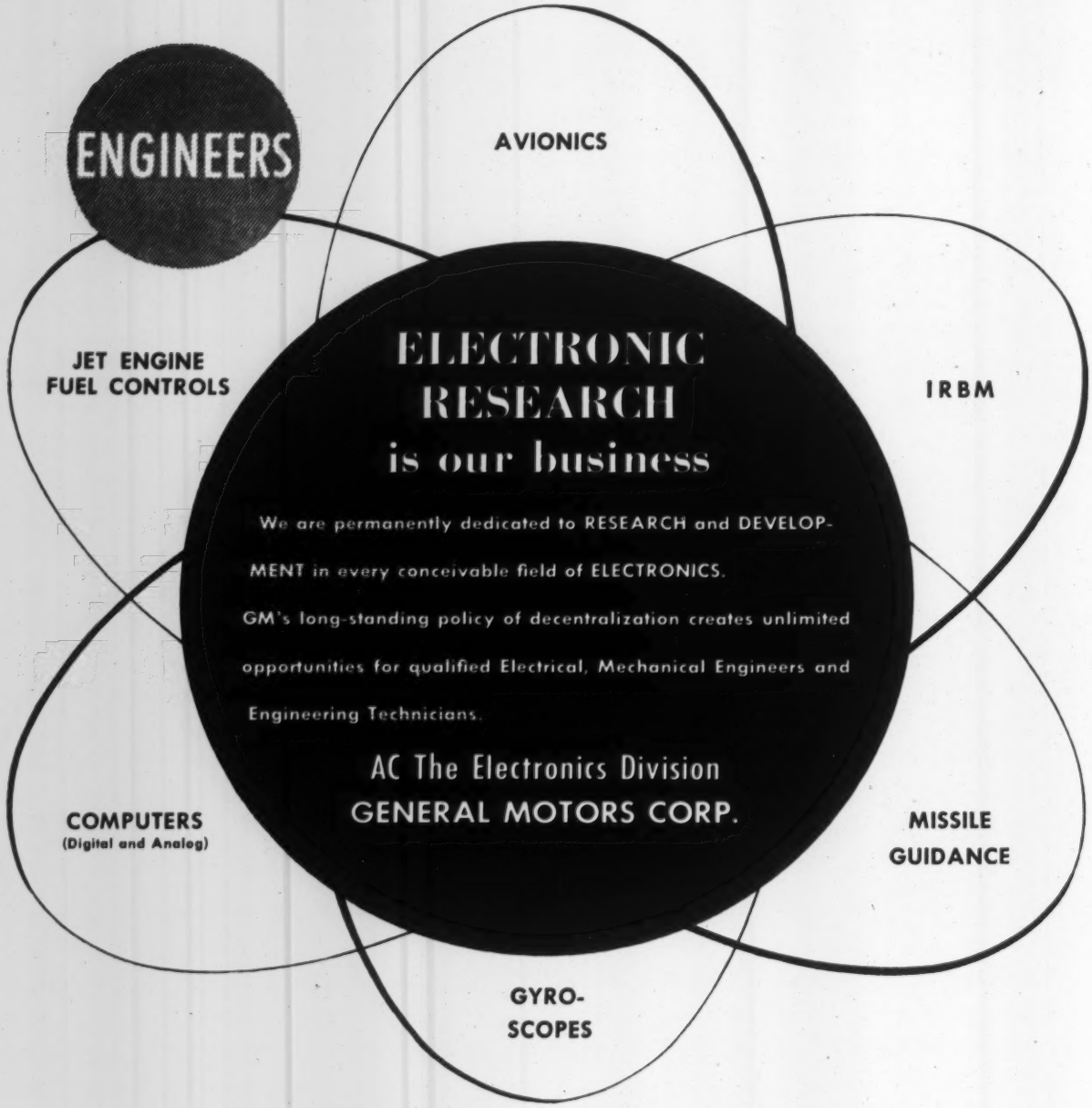
Dear Sir: Please send me your brochure detailing life and work at Lockheed.

Name

If you are an engineer, please state your field of engineering

Home street address

City and State Home phone


ENGINEERS
AVIONICS
JET ENGINE FUEL CONTROLS
IRBM
ELECTRONIC RESEARCH is our business
We are permanently dedicated to RESEARCH and DEVELOPMENT in every conceivable field of ELECTRONICS.
GM's long-standing policy of decentralization creates unlimited opportunities for qualified Electrical, Mechanical Engineers and Engineering Technicians.
AC The Electronics Division
GENERAL MOTORS CORP.
COMPUTERS (Digital and Analog)
MISSILE GUIDANCE
GYRO-SCOPES

New plant (225,000 square feet) now being built in a Milwaukee suburb. This and our present plant will house the ELECTRONICS DIVISION—Milwaukee of the General Motors Corporation.

Your future is assured (if you can qualify) in this lovely cool, southern Wisconsin city where every conceivable living and cultural advantage, plus small town hospitality is yours for the asking. Send full facts today about your education, work background, etc. Every inquiry treated in strict confidence—and you will hear from us by return mail.

For Employment Application—Mr. John F. Heffinger, Supervisor of Technical Employment

AC THE ELECTRONICS DIVISION
GENERAL MOTORS CORPORATION
Milwaukee 2, Wisconsin Flint 2, Michigan

MECHANICAL ENGINEERS
$6000–$8000

Several excellent openings with multi-plant company in installation and maintenance of packaging equipment, electro-mechanical instruments, production, project and process; recent grads or experienced. Employer pays our fee and expenses. Send resume and photo to Mr. H. A. Jensen

WALKER EMPLOYMENT SERVICE
212 So. 7th St. Minneapolis 2, Minn.

ENGINEER
RESEARCH & DEVELOPMENT

BS in Mechanical, Electrical or Electronic Engineering. 5–10 years in Development and Design of Mechanical or Electro-Mechanical devices. Experience in Design of Control Valves and Automatic Controls desirable.

We desire an original thinker who can supply and develop new ideas for an expanding line of Control Valves and Automatic Control devices and follow through to the finished product.

Forward looking, steady growth company with broad program of liberal employee benefits, pleasant working conditions. 30 minutes from Mid-town New York.

An excellent opportunity for the right man.

LESLIE CO.
Grant Ave. Lyndhurst, N. J.

PROJECT ENGINEERS

Challenging and interesting positions are open in Worthington Corporation for qualified mechanical engineers who seek opportunities as project leaders in product research and development. This is a chance to attain personal growth and profession standing with a growing organization that serves the air conditioning, petro-chemical, refinery and public utility fields. Work will be with such equipment as centrifugal pumps, compressors and various types of power plant equipment. Location is in northern New Jersey. Salaries commensurate with experience. Liberal benefits, including educational refund plan. Write for interview, enclosing a resume of your background, to

Personnel Department, Harrison Division
WORTHINGTON CORPORATION
Harrison, New Jersey

RESEARCH ENGINEERS

The Armour Research Foundation has a limited number of top level research positions for individuals possessing a high degree of ingenuity and imagination. These positions provide excellent advancement opportunities into management or senior research positions, of equivalent rank, in the following general fields:

Aerophysics
Combustion
Heat Transfer
Thermodynamics
Compressible and Incompressible Flow
Weapons Systems Analysis

Only individuals capable of applying their proven research abilities within the above fields will be considered. Excellent educational and other employee benefits. Salary open. Please send resume to:

Mr. J. A. Metzger
ARMOUR RESEARCH FOUNDATION
of
Illinois Institute of Technology
10 West 35th Street
Chicago, Illinois

DESIGNERS

...if YOU are interested in MORE than "just a job"

DU PONT is interested in YOU!

To a designer who seriously wants to grow in his field,
Du Pont Offers Real Opportunity.

Work on interesting, challenging, professional assignments. Du Pont's vast research program assures diversification. Your assignments will include work in synthetic fibres, heavy chemicals, pigments, finishes, plastics, photo products, electrochemicals and many other fields.

Progress and promotion are commensurate with ability and performance.

Comprehensive and varied training programs to develop both technical and administrative abilities.

Promotion-from-within. This, plus continuous Company growth, assures both excellent advancement opportunities and stability.

Progressive benefit programs provide immediate and long-term security — majority company-paid.

APPLY NOW to fill one of these immediate openings for:

PROCESS DESIGNERS
PROCESS EQUIPMENT DESIGNERS
MECHANICAL DESIGNERS
INSTRUMENT DESIGNERS
POWER DESIGNERS

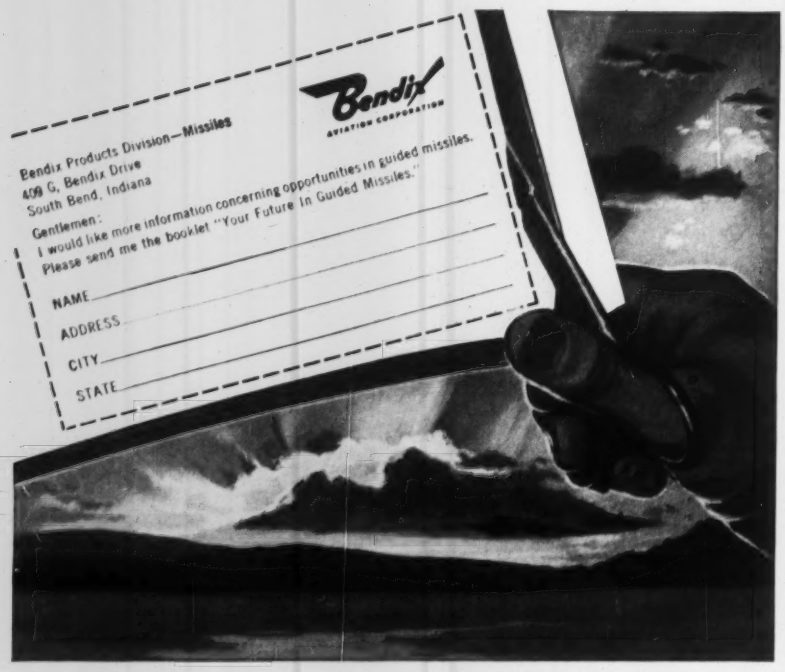
Please send complete resume, including details of education and experience, to:
Mr. T. J. Donovan
Engineering Department

DU PONT
REG. U.S. PAT. OFF.

Better Things for Better Living through Chemistry

E. I. du Pont de Nemours & Co., Inc.
Wilmington 98, Delaware

This coupon mailed TODAY



...may bring you a brighter TOMORROW!

There just isn't any question about it—the trained engineer of today has more opportunity than ever before.

However, and this is vitally important, the possibility for individual progress is far greater in certain organizations than in others. That's why every engineer concerned with his future should look into the job opportunities offered in the guided missile field.

Here at Bendix Products Division—Missiles, you can get in on the ground floor of a new, but proven, dynamic business with long-term potentials in the development, engineering and manufacturing of the nation's most important weapons system. It is truly the business of the future with many commercial as well as military applications.

Then, too, at Bendix Products Division—Missiles, you have all the advancement possibilities of a compact, hard-hitting organization backed by the resources of the entire nation-wide Bendix Aviation Corporation.

So that you may analyze for yourself the various job opportunities and the possibilities of rapid advancement, we have prepared a thirty-six-page book which gives detailed background of the functions of the various engineering groups.

Any ambitious engineer looks forward to a brighter tomorrow. May we suggest that the first step toward this goal is the mailing of the coupon for your copy of "Your Future in Guided Missiles".

Prime Contractor for TALOS MISSILE

TRANSLATOR (technical) and ABSTRACTOR

For Research Department of large steel company. Thorough knowledge of German and French required, some understanding of other languages desirable. Scientific education and some practical experience in engineering—metallurgical, chemical, or mechanical—are essential. Please send resume, stating salary desired.

Address CA-6037, % "Mechanical Engineering."

MECHANICAL ENGINEERS

Several excellent opportunities available with major producer of synthetic fibers and films. Openings are current in plant engineering departments in Pennsylvania, Virginia, and West Virginia.

Graduate mechanical engineers with 0–5 years of experience in machine and equipment design, mechanical layout, engineering maintenance, or related activities are invited to reply.

Please send resume including details of education, experience, and salary requirements to:

Personnel Recruitment Department
AMERICAN VISCOSE CORPORATION
1617 Pennsylvania Boulevard
Philadelphia 3, Pennsylvania

Mechanical Engineers and Designers

BECHTEL

Offers you immediate long range engineering opportunity in

Los Angeles
New York
or
San Francisco

Engineers and designers with Steam Electric Generating Station, Refinery, or Process Plant experience will qualify. Mechanical engineers with related experience will be given thorough consideration.

Instrument Application Engineers

Mechanical engineers with instrument application experience on Steam Electric Generating Stations, Refinery, or Process Plants. Related experience acceptable.

Liberal relocation allowances for you and your family.

Send resume to
Manager of Employment & Placement
Industrial Relations Division

BECHTEL
CORPORATION
220 Bush Street
San Francisco 4, Calif.

For an immediate personal interview you may phone:
Paul Keating, Murray Hill 7-7100, New York City
Joe Braddick, Fairfax 3-2401, Houston, Tex.
Bill Milligan, Tucker 1549, Los Angeles, Calif.
Don Palmer, Douglas 2-4032, San Francisco, Calif.

See advertisements on preceding pages

ICBM

to be guided by **UNIVAC**

New applications are continually being found for Remington Rand Univac electronic computing systems. They are playing a vital and versatile role in scientific research, business, industry, communications and transportation. Now Univac is engaged in the design and development of a guidance system for the Air Force's Intercontinental Ballistics Missile—a system which will guide such missiles as the "Atlas" and the "Titan."

Univac offers engineers and technicians opportunities in virtually every field of professional interest. The diversity of its operations means stability and continued growth for Univac—and for members of the Univac team. Univac offers you interesting assignments, excellent opportunities and starting salaries that are among the highest in the field. Say: "I'm with Univac." Investigate the following permanent positions.

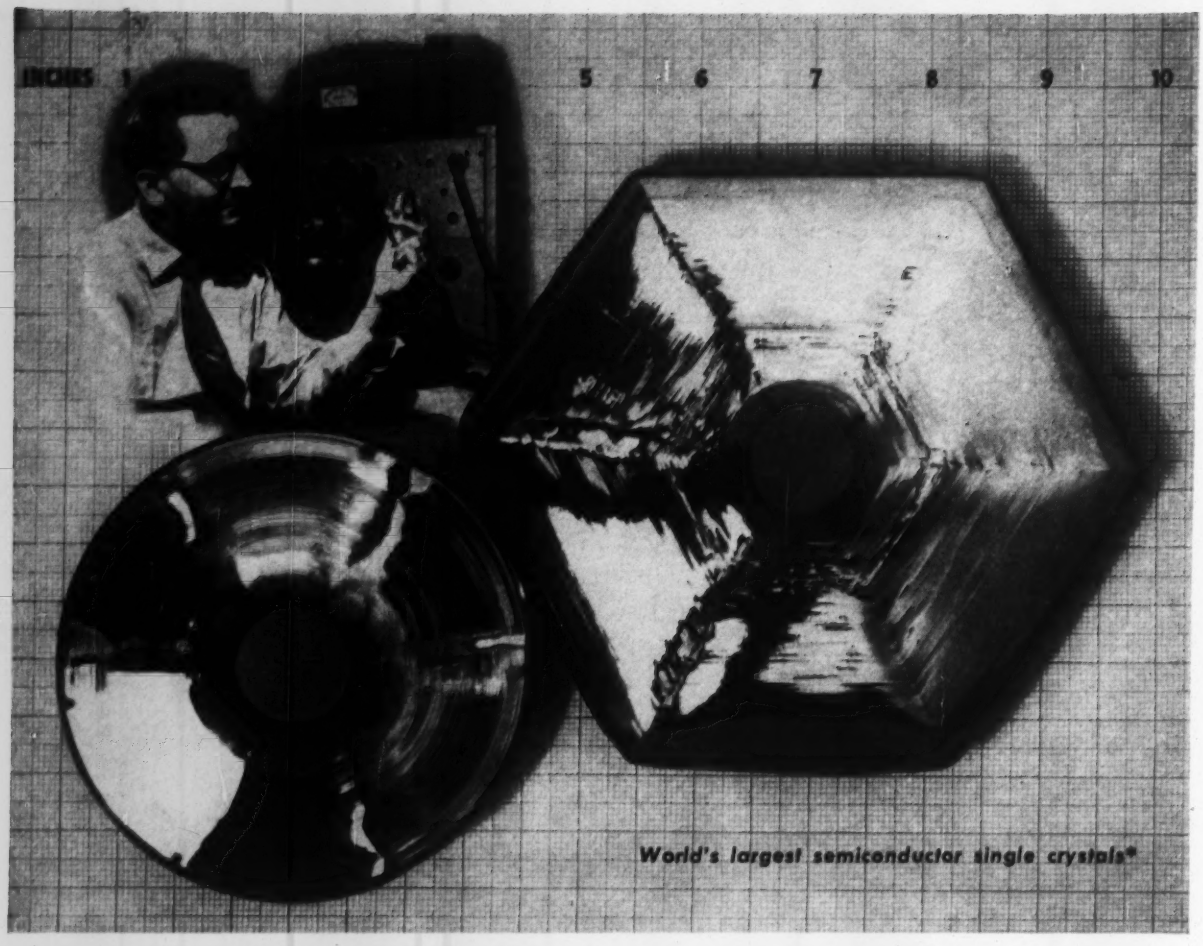
IMMEDIATE OPENINGS FOR MECHANICAL ENGINEERS

For development engineering work in computer input mechanisms consisting of cards, tapes and keyboard devices, computer memory devices and high-speed output printing mechanisms. Will design cabinet structures, component packaging, cooling and ventilating systems and miniaturized components.

Send complete resumé to

Remington Rand Univac

DIVISION OF SPERRY RAND CORPORATION
J. H. WOODBURY
Dept. SJ-4
1902 W. MINNEHAHA AVE., ST. PAUL W4, MINNESOTA



*World's largest semiconductor single crystals**

ENGINEERS / PHYSICISTS

You are invited to join one of these expanding programs at Texas Instruments – where recognition of individual achievement has contributed to its fifteenfold growth in the last ten years. Advanced personnel policies include company-sponsored educational assistance, profit sharing, insurance and pension plans.

The TI plant is within Dallas, yet away from downtown traffic . . . within 5 minutes of fine residential areas, churches, and public and private schools. Your home will be within 15 minutes of year-around recreational, amusement, and cultural facilities.

* Produced in connection with the many investigations into solid state physics and electrical phenomena being carried on by Texas Instruments Incorporated . . . leading manufacturer of semiconductor products . . . 26-year-old pioneer and leading supplier of geophysical exploration services . . . currently engaged in design, development, and manufacture of electronic components, instruments, optics, and military apparatus — at a $44 million volume.

SEMICONDUCTOR DEVICES AND OTHER COMPONENTS

transistors • transistor circuits
diodes • rectifiers
transformers • resistors
panel meters
test equipment

Address SEMICONDUCTOR-COMPONENTS replies to:
Mr. William C. Spaller

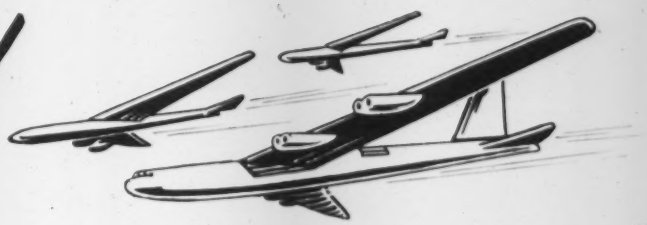
ELECTRONIC AND ELECTRO-MECHANICAL APPARATUS

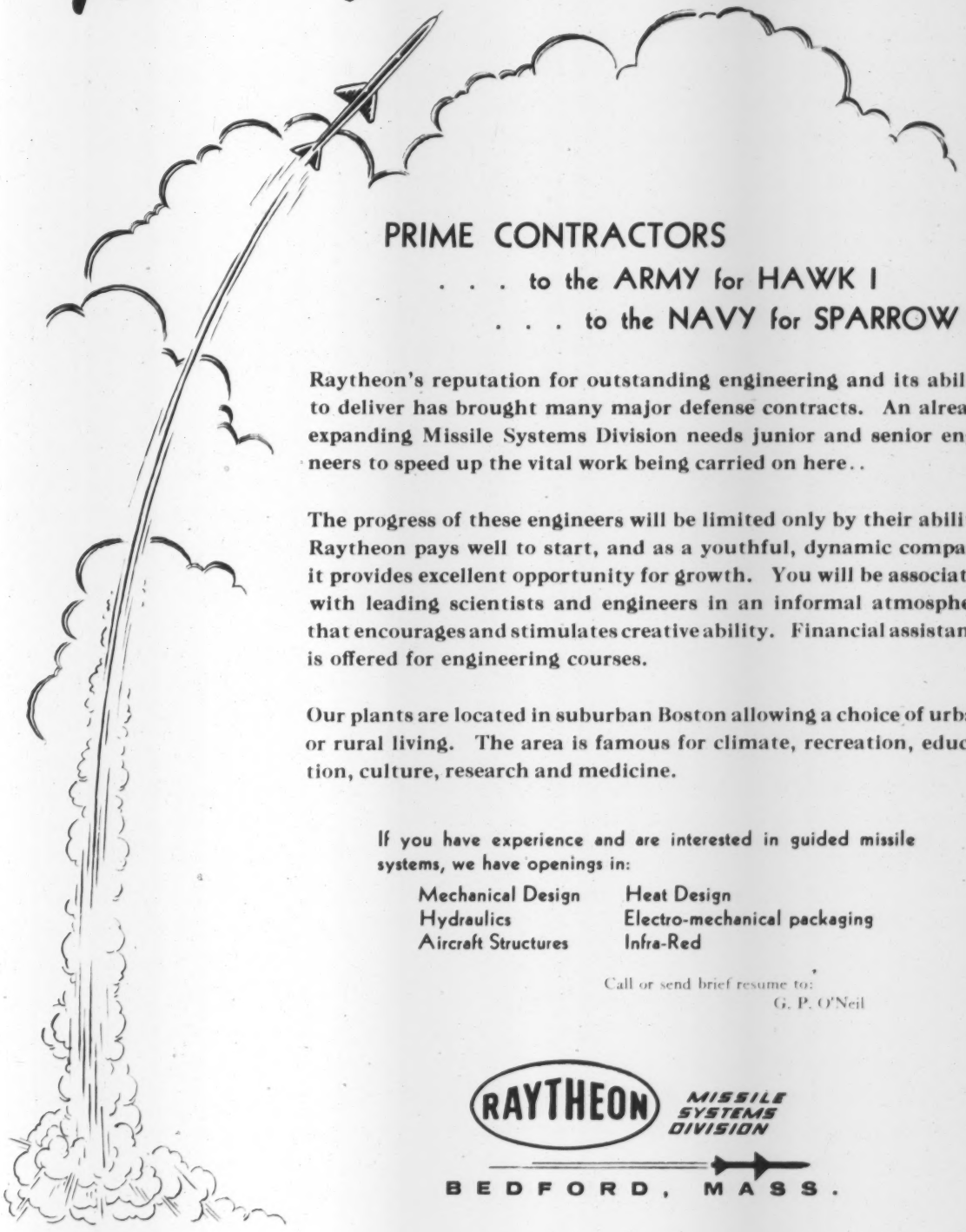
radar • sonar • infrared
navigation • magnetics
telemetering
communications
computers

Address APPARATUS replies to:
Mr. Robert E. Houston

TEXAS INSTRUMENTS
INCORPORATED
6000 LEMMON AVENUE DALLAS 9, TEXAS

Here we go!





PRIME CONTRACTORS

. . . to the ARMY for HAWK I

. . . to the NAVY for SPARROW III

Raytheon's reputation for outstanding engineering and its ability to deliver has brought many major defense contracts. An already expanding Missile Systems Division needs junior and senior engineers to speed up the vital work being carried on here..

The progress of these engineers will be limited only by their ability. Raytheon pays well to start, and as a youthful, dynamic company it provides excellent opportunity for growth. You will be associated with leading scientists and engineers in an informal atmosphere that encourages and stimulates creative ability. Financial assistance is offered for engineering courses.

Our plants are located in suburban Boston allowing a choice of urban or rural living. The area is famous for climate, recreation, education, culture, research and medicine.

If you have experience and are interested in guided missile systems, we have openings in:

Mechanical Design	Heat Design
Hydraulics	Electro-mechanical packaging
Aircraft Structures	Infra-Red

Call or send brief resume to:
G. P. O'Neil

RAYTHEON MISSILE SYSTEMS DIVISION

BEDFORD, MASS.

ENGINEERS FOR IMMEDIATE PLACEMENT

- **Electrical engineers**
- **Mechanical engineers**
- **Electronic engineers**
- **Computer engineers**
- **Solid-state physicists**

ENGINEERING AT NCR MEANS:

IMMEDIATE, PERMANENT POSITIONS in Mechanical Engineering, Electrical Engineering and Physics Research Division.

ENGINEERING PROJECT WORK in Adding Machines, Cash Registers, Accounting Machines, Computers and related Data Processing Equipment in Dayton, Los Angeles and Ithaca, New York.

OPPORTUNITIES IN DESIGN, development, production-engineering and packaging of mechanical, electronic and electro-mechanical devices.

SOME EXPERIENCE IN DEVELOPMENT, design and application of high-speed, light-weight mechanisms of the intermittent-motion type—or experience in digital devices and components is desirable, but not essential.

AMPLE TRAINING and orientation is available to all employees.

ENGINEERS

AS AN NCR ENGINEER, YOU WITH YOUR FAMILY, WILL ENJOY:

UNLIMITED OPPORTUNITY in the broad, ever-expanding field of Business Machine Engineering and Research.

AN EXCELLENT SALARY, plus exceptional benefits of lifetime value for you and your family.

A RECREATIONAL PROGRAM for year-round enjoyment for the entire family, including a new NCR Country Club with 36 holes of golf, and a 166-acre employees' park for outings with swimming, boating and supervised play for children.

LIVING IN DAYTON—an attractive, progressive city with outstanding school facilities.

YOUR WORK AT NCR with its friendly, family atmosphere, where you work with people who, like yourself, have decided to build their professional future with NCR.

ACT AT ONCE

Send resume of your education, experience and geographic preference to:
Employment Department,
Professional Personnel Section 2

THE NATIONAL CASH REGISTER COMPANY • DAYTON 9 • OHIO

ENGINEERS

ELECTRIC
BOAT
STEPS-UP
NUCLEAR
SUBMARINE
PROGRAM

offers unusual growth opportunities to engineers

Two years ago, world attention centered on Electric Boat at Groton, Connecticut where scientific boldness harnessed the power of atomic energy to launch the Nautilus, the world's first nuclear powered submarine. Next to glide down the ways will be even more powerful versions . . . a second, third, fourth and fifth nuclear powered craft.

Now, engineers who are cognizant of the implications of the Atomic Age are concentrating their interest on Electric Boat. The following opportunities exist for:

a) **Naval Architects**

b) **Mechanical and Electrical Engineers** with 3 to 5 years' experience in the application of mechanical and electrical marine power plant equipment.

c) **Electrical and/or Mechanical Engineers** for basic design using analog computers, with respect to control systems, motor control circuits, power plant, speed and voltage regulators or fluid flow and thermodynamics. Familiarity with engine room and reactor plant electrical systems and controls desirable.

At Electric Boat your professional success is spurred by company sponsored courses at the plant, advanced study at leading universities, and by attention to broader professional growth by immediate supervision.

Electric Boat's location in Groton on the lovely shore of Long Island Sound makes life as pleasant as your job is stimulating. The surrounding resort area is well known for its year-round sports and recreational activities. And, you have all the advantages of nearby New York and Boston as well.

Interviews can be arranged by sending resumes to Peter Carpenter.

ELECTRIC BOAT
Division of General Dynamics Corporation
GROTON • CONNECTICUT

POSITION OPEN

Young engineer, metallurgical, mechanical, or aircraft structural, for technical-administrative position in large, comprehensive, long range materials project. Should like to write and edit technical reports, deal daily with engineering personnel, meet new people, and assume some administrative responsibilities. Will work directly with experienced technical personnel in informal, fast-moving, congenial environment. Will consider exceptionally qualified new graduate.

BATTELLE
MEMORIAL INSTITUTE
505 King Avenue, Columbus 1, Ohio

Engineers

MECHANICAL DESIGN

at the Small Aircraft Engine Dept. of General Electric

means more career potential

You'll be working on such advanced and stimulating problems as how to develop a gas turbine with a power-weight ratio of more than 4 to 1—in the class of our T58, which delivers 1050 HP, weighs only 325 lbs. It involves the design of a variety of static and moving parts: compressors, combustors, turbines, control components, gear and lube systems. It requires men with knowledge of high speed machine design, and experience in any of the following fields:

- **stress analysis**
- **experimental analysis of mechanics**
- **solid mechanics**
- **vibrations analysis**
- **mechanical analysis**

And at this young, decentralised department an able man quickly advances to a position of responsibility, aided in every way by General Electric's outstanding benefits and a professional development program. And Boston's cultural and educational facilities—plus the recreational advantages of all New England—are within easy reach.

Write in complete confidence to:
Mr. T. S. Woerz (Section RA-1)

Small Aircraft Engine Dept.

GENERAL ELECTRIC

1000 Western Avenue **West Lynn, Mass.**

TO ALL ENGINEERS (ELECTRICAL, MECHANICAL, AERONAUTICAL, CHEMICAL)
METALLURGISTS, CHEMISTS, MATHEMATICIANS, PHYSICISTS.

How did you do in '56?

Engineers and Scientists from Many Fields Urgently Needed for Rocket Work at Reaction Motors

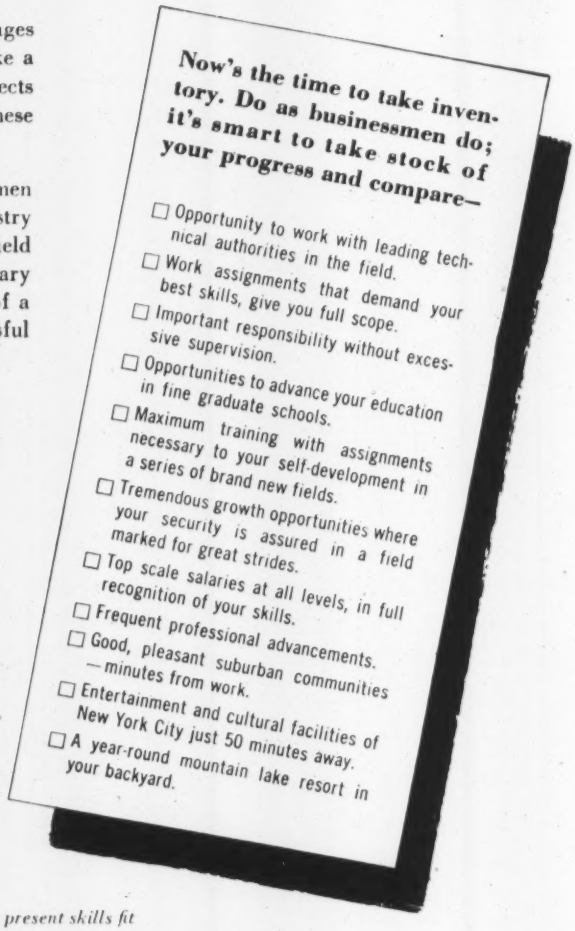
This is the time to consider all the advantages and disadvantages of your present position and decide whether you should make a change in '57. Once you've taken stock of '56 and your prospects for '57, you will find it well worth your while to consider these unsurpassed career positions.

Reaction Motors offers high-calibre positions to professional men with or without rocket experience—no faster growing industry or company in America—earn top salaries and benefits in a field known for its big rewards—enjoy advantages of both military and industrial applications. If you have worked in any one of a large number of diverse fields, RMI can turn you into a successful rocket man—FAST.

LOOK OVER THE BROAD RANGE OF EXPANSION-CREATED ASSIGNMENTS IN OUR MAIN PROJECT AREAS:

Missiles—Piloted aircraft—Launching devices—Ground support equipment—Liquid and solid propellant chemistry—Nuclear rockets

Engine design
Project engineering
Test
Analog simulation
Chemical kinetics
Instrumentation
Aerodynamics
Data reduction
Controls (hydraulic, pneumatic, electrical)
Combustion phenomena
Applications engineering
Fluid flow
Thermostress and vibration
Servo mechanisms
High temperature alloys
Nuclear applications
Technical planning (advanced design)
Proposals


Now's the time to take inventory. Do as businessmen do; it's smart to take stock of your progress and compare—
☐ Opportunity to work with leading technical authorities in the field.
☐ Work assignments that demand your best skills, give you full scope.
☐ Important responsibility without excessive supervision.
☐ Opportunities to advance your education in fine graduate schools.
☐ Maximum training with assignments necessary to your self-development in a series of brand new fields.
☐ Tremendous growth opportunities where your security is assured in a field marked for great strides.
☐ Top scale salaries at all levels, in full recognition of your skills.
☐ Frequent professional advancements.
☐ Good, pleasant suburban communities —minutes from work.
☐ Entertainment and cultural facilities of New York City just 50 minutes away.
☐ A year-round mountain lake resort in your backyard.

To find out just where YOUR *present skills fit in with the growing RMI picture, drop us a note or card. (Include address and phone number.) For immediate action, ask for an application form, or send complete resume to* ***Supervisor of Technical Personnel***

Power for Progress

RMI

REACTION MOTORS, INC.

A MEMBER OF THE OMAR TEAM

70 FORD ROAD, DENVILLE, N. J.

MECHANICAL ENGINEER
NEW PRODUCT DEVELOPMENT

Opportunity for Mechanical Engineer with BSME (or equivalent) and four to six years of experience in Mechanical Design to do product development work on air compressors and construction equipment for Mining and Construction Division, Joy Manufacturing Company.

Applicants with good working knowledge of thermodynamics and fluid mechanics will be given select consideration. Salary commensurate with experience and ability. Opportunity for advancement on same basis. Age desired 26-35.

Joy builds heavy machinery for Construction and Petroleum exploration and production, and General Industry and is the world's largest manufacturer of mining machinery.

JOY MANUFACTURING COMPANY
PERSONNEL DEPARTMENT
MICHIGAN CITY, INDIANA

QUALITY CONTROL ENGINEERS
For Positions In
NUCLEAR WEAPONS FIELD

Responsibilities include the analysis of data, assignment and interpretation of sampling plans, training, evaluation of inspection effectiveness and product quality. Applicants must have a degree in Mathematics, or in Mechanical or Electrical Engineering.

Please send resume to:

Staff Employment Section 553
SANDIA CORPORATION
Albuquerque, New Mexico

MECHANICAL ENGINEERING
OPPORTUNITIES
in
ATOMIC ENERGY

DESIGN

TESTING

PRODUCTION

MAINTENANCE

INSTRUMENTATION

OPERATIONAL ANALYSIS

RESEARCH AND DEVELOPMENT

ACTIVITIES

Design, development, testing, and operation of nuclear reactors and component parts for research, production, power, and aircraft propulsion.

Design and development of pilot and production plants and processes in the over-all atomic energy programs.

Production of barrier and barrier materials, fluorine, and UF6 feed, all directly associated with the concentration of U-235; radioactive and stable isotopes; and special materials required for reactor and other atomic energy programs.

Operation and maintenance of existing facilities.

Fundamental and applied research in the over-all atomic energy programs.

Openings at all Degree Levels, 0–8 years' experience in the

GASEOUS DIFFUSION PLANTS, OAK RIDGE, TENN. AND PADUCAH, KY.
OAK RIDGE, NATIONAL LABORATORY
OAK RIDGE Y-12 PLANT

Exceptional opportunities, modern and unique facilities, liberal benefit plans, educational and training programs, plant interview and moving expenses, moderate climate, year around outdoor recreational activities, low cost living, available housing.

Send resume and salary information to

TECHNICAL PERSONNEL OFFICE

UNION CARBIDE NUCLEAR COMPANY
a division of
UNION CARBIDE AND CARBON CORPORATION

Post Office Box P **Oak Ridge, Tennessee**

ATTENTION!
MECHANICAL ENGINEERS

HERE ARE EXCEPTIONAL OPPORTUNITIES TO ADVANCE IN AN ELECTRONIC ORGANIZATION

- We need Mechanical Engineers . . . not only for design work . . . but men who are also capable of working up to the Project Engineer level in our organization.
- We are looking for mechanical men with some experience in small mechanical or electro-mechanical equipment.
- There are positions **at all levels** for such work as packaging electronic equipment, making vibration analyses, designing light weight structures, etc. We are advancing our own mechanical men in electronic work, but we need you, too.
- *Please air mail your qualifications or send the coupon today.*

W. C. Walker, Engineering Employment Mgr.
Pacific Division, Bendix Aviation Corp.
11604 Sherman Way, North Hollywood, Calif.

I am interested in this engineering field ____
I am a graduate engineer with ____ degree.
I am not a graduate engineer but have ____ years experience.

Name _____
Address _____
City _____
Zone ____ State _____

"OPPORTUNITIES" 145-164

CHIEF ENGINEER

Graduate Mechanical Engineer with at least 10 years' experience in Rayon Industry, preferably in staple, to take charge of Engineering Department. Scope of position covers maintenance, power, design and construction. Administrative ability required.

Please send full resume and salary requirements to:

HARTFORD RAYON COMPANY
Rocky Hill, Connecticut

MR. ENGINEER

We would like to talk with you about your business career. Firestone is entering several new technical fields and your connection would be important in the development of these projects. We would like to tell you about our plans and work as a designer, project or process engineer. May we suggest you write us now outlining your education and experience in order that we can give you complete details of our new program as well as consideration concerning employment. All negotiations confidential.

Write to: Technical Division
Personnel Department
The Firestone Tire & Rubber Co.
Akron, Ohio

VALVE AND NUCLEAR ENGINEERS

Aggressive Research and Development activities have made Edward Valves, Inc. a leader in the steel valve industry.
We have expanded our Research facilities to maintain this position.
Openings are for Engineers (mechanical, stress, flow, materials, metallurgists) interested in design and development of valves for high pressure, high temperature service and nuclear power applications. Replies are confidential.

EDWARD VALVES, Inc.
Subsidiary of the Rockwell Manufacturing Company
1200 West 145th Street, East Chicago, Indiana
Write or contact Mr. E. A. Loeser, Engineering Personnel

SALES ENGINEERS

Recent Engineering graduates, preferably M.E., for approximately one year inside sales training prior to assignment to a territory. Send complete resume to Personnel Department.

EDWARD VALVES, INC.
Subsidiary of Rockwell Manufacturing Company
1200 West 145th Street
East Chicago, Indiana

INSTRUCTOR or ASSISTANT PROFESSOR—to teach mechanics, dynamics, vibrations, stress analysis. Master's degree and some industrial experience preferred. Mechanical Engineering Department, Oregon State College, Corvallis, Oregon.

TEACHING POSITIONS—Applicants needed for additional permanent staff starting September 1957, in Electrical, Mechanical and Civil Engineering. Salary and rank open. Institution fully accredited, complete new Engineering School facilities, relatively small enrollment. Climate high, dry, and pleasant. Town of 20,000 free from usual big city inconveniences and irritations. Retired engineers and teachers considered. Send complete outline or inquires to Dean of Engineering, Colorado A & M College, Fort Collins, Colorado.

ASSISTANT or ASSOCIATE PROFESSOR in Mechanical Engineering—Appointments available in the field of Heat Power or Industrial Processes. Teaching loads arranged to permit time for research. All appointments on nine months basis. Write: Dept. of Mechanical Engineering, University of Nebraska, Lincoln 8, Nebraska.

INSTRUCTOR, ASST. PROF., ASSOC. PROF., PROFESSOR OPENINGS—to teach thermodynamics, heat transfer, fluid mechanics, machine design, stress analysis, nuclear engineering, shop processes or combinations in fields mentioned. M.S. required, Ph.D. desirable. Rank and salary commensurate with qualifications. Opportunities for sponsored research and consulting. Write Prof. C. T. Grace, Chairman, Mechanical Engineering, University of New Mexico, Albuquerque, New Mexico.

MECHANICAL & INDUSTRIAL ENGINEERS—Career opportunities with progressive company. Desirable plant location offering good schools, housing, shopping and recreational facilities. Immediate openings in Methods, Production and Industrial Engineering. Salary commensurate with contribution. Progressive employee benefits. Write R. G. Commo, Industrial Relations Manager, Giddings & Lewis Machine Tool Company, Fond du Lac, Wisconsin.

ASSISTANT and ASSOCIATE PROFESSOR of Engineering—Able young Ph.D's interested in teaching and research in equal amount. Well equipped and active professorial staff in thermodynamics and fluid mechanics is expanding to size comparable with internationally known group in mechanics of solids. Excellent opportunity for development and advancement. Write to Prof. J. Kestin, P. F. Maeder, or R. F. Probstein, or to D. C. Drucker, Chairman of Division of Engineering, Brown University, Providence 12, R. I.

POSITIONS WANTED

CANADIAN MECHANICAL ENGINEERING student graduating Spring 1957, desires to contact companies with Latin American subsidiaries with a view towards permanent employment. Married. Speaks fluent Spanish. Latin American experience. Address CA-6051, care of "Mechanical Engineering."

PRODUCT DEVELOPMENT and DESIGN SPECIALIST—Mechanical Engineer, 42. Past four years as Project Engineer for coal industry research laboratory on automation, combustion and steam generator design. Background includes six years' teaching Physics, and extensive experience in power plant and industrial utilities. Address CA-6052, care of "Mechanical Engineering."

MECHANICAL ENGINEER—BSME, 35, professional engineer. Now plant engineer for large industry with multi plant operation, responsible for maintenance, operation and housekeeping. Varied experience including design, estimating, operation, maintenance, application mechanical equipment. Location preferred southwest, west. Address CA-6045, care of "Mechanical Engineering."

Ambitious Hard Working, Management Minded MECHANICAL ENGINEER, M.S.M.E., B.S.I.E. 29, citizen, Q-Clearance, 5 years' engineering, sales and administrative experience, fluent French, German, Spanish, seeks responsible, permanent position with a dynamic company. Address CA-6044, care of "Mechanical Engineering."

EMPLOYMENT AGENCIES AND SERVICE BUREAUS

SALARIED POSITIONS—$6,000 to $35,000. We offer the original personal employment service (established 46 years). Procedure of high standards individualized to your personal requirements. Identity covered. Particulars—R. W. Bixby, Inc., 562 Brisbane Bldg., Buffalo 3, N. Y.

EXECUTIVES, ENGINEERS, DESIGNERS, SPECIALISTS, 66 associate offices—principal cities. Our staff—technical graduates—no fee until placed—Bradley Placement Service, 555 Leader Building—Cleveland 14, Ohio.

SALARIED PERSONNEL $5,000 to $30,000

This nation-wide service, established 1927, is geared to the needs of high grade men who seek a change of connection under conditions, assuring if employed full protection to present position. Send name and address only for details. Personal consultation invited.

JIRA THAYER JENNINGS
Dept. J, P. O. Box 674, Manchester, Vermont

CHIEF ENGINEER

You will direct the development group for old line manufacturer process machinery. Starting salary $15,000 plus liberal bonus. Company pays agency fee and relocation expense.

28 E. Jackson **Chicago 4, Illinois**
MONARCH PERSONNEL

EXPERIMENTAL PHYSICISTS, METALLURGISTS, PHYSICAL CHEMISTS AND ENGINEERS
OPPORTUNITIES IN
RESEARCH, INSTRUMENTATION, DEVELOPMENT, FIELD TESTING

Permanently established research program. Located in town of 5000 population. Excellent year-round climate with exceptional outdoor recreational facilities.

Write to: Personnel Manager
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY
Campus Station, Socorro, New Mexico

SERVICES AVAILABLE

SAFETY—25 years' experience, nation wide, industry, traffic, construction, elevators, insurance and all their educational and economic relations. ASME-ASSE-Veterans of Safety. Position or consultant. Address CA-6042, care of "Mechanical Engineering."

***READ the* CLASSIFIED ADVERTISEMENTS**

appearing in this section each month.

RESUMES

SCIENTIFIC ENGINEERING TECHNICAL RESUMES OUR SPECIALITY
Expertly typed, carefully proof read, attractive layout. Reproduced by multilith on quality bond papers. $4.00 for 50 copies of one page. $5.00 for 100 copies. Postpaid. To assist you, additional copies will be reproduced and distributed to major firms (excluding your present employer) at no cost to you.
Send for "How to Write Your Resume" including sample guide—$1.50 postpaid.

ORVILLE E. ARMSTRONG & CO.
55 W. 42nd St., Dept. ME, New York 36, N. Y.

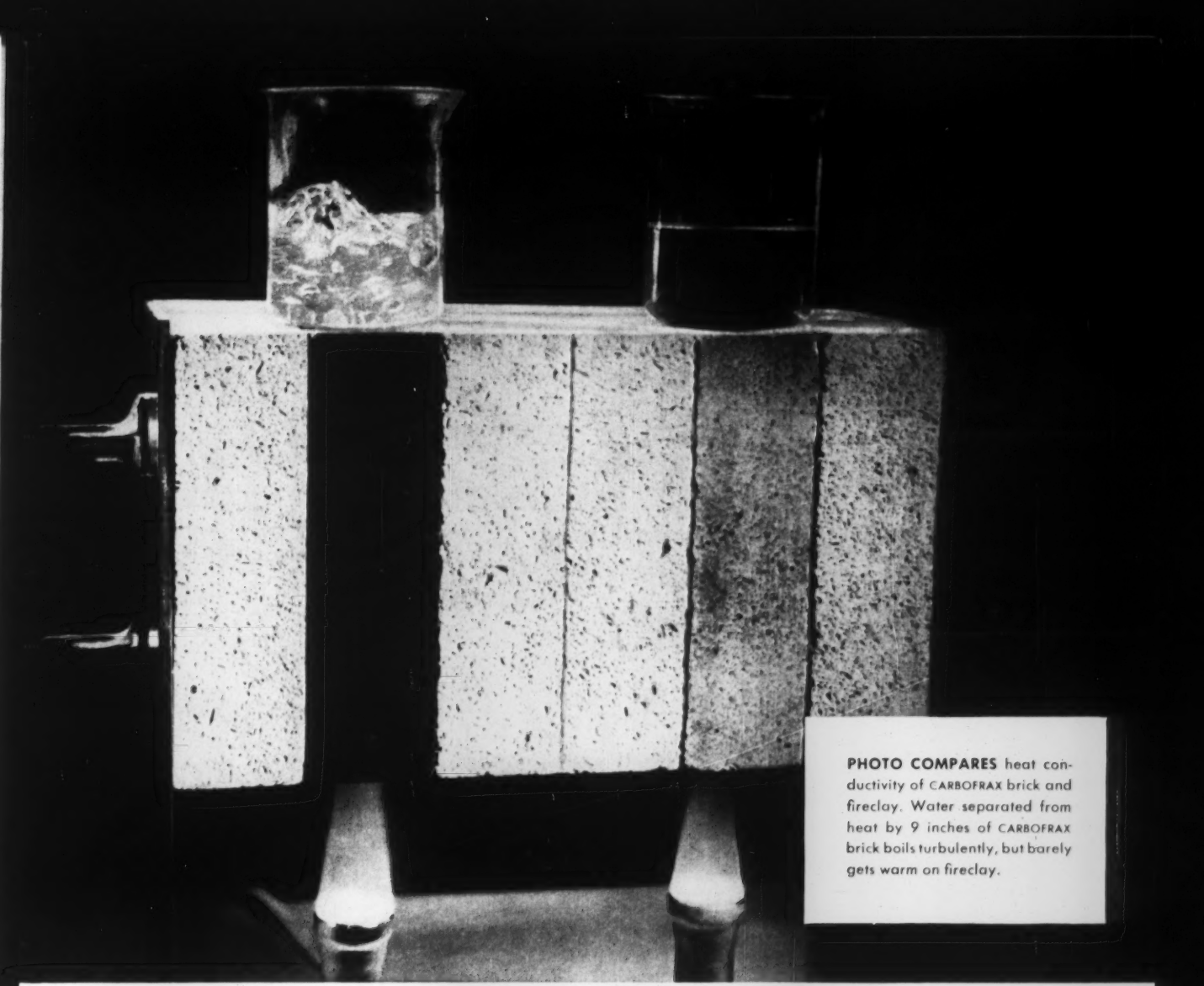


PHOTO COMPARES heat conductivity of CARBOFRAX brick and fireclay. Water separated from heat by 9 inches of CARBOFRAX brick boils turbulently, but barely gets warm on fireclay.

Refractories–for high heat conductivity

High heat conductivity—roughly 11 times that of fireclay and about 70% that of chrome-nickel steels—is one of the properties of CARBOFRAX® silicon carbide refractories. It is an ideal material for muffles, radiant tubes, retorts and similar structures where you need exceptional resistance to direct flame plus the ability to conduct heat efficiently. At 2200°F, thermal conductivity of CARBOFRAX brick is 109BTU/hr., sq. ft. and °F/in. of thickness.

CARBOFRAX refractories typify the many super refractories pioneered by Carborundum. Each has a wide range of properties. One, for example, is formed into precision parts that look like cast iron yet resist over 3000°F. Another, a new ceramic fiber, filters and insulates at temperatures no existing mineral or glass fiber can take.

CARBORUNDUM
Registered Trade Mark

For valuable information about high temperature problems—and other pertinent information about refractories—or for help on your own particular problem—fill in and mail this coupon today:

MAIL THIS COUPON TODAY

Refractories Division,
The Carborundum Company, Perth Amboy, N. J., Dept. 117

Please send me:

- ☐ Forthcoming issue of Refractories Magazine
- ☐ Bulletin on Properties of Carborundum's Super Refractories
- ☐ Here is a description of my high temperature problem. Can you help me?

Name _____ Title _____

Company _____

Street _____

City _____ Zone _____ State _____

Consulting Service

Manufacturers of equipment not included

RATES: One-inch card announcements inserted at rate of $20 each issue, $15 per issue on yearly contract

BLACK & VEATCH
CONSULTING ENGINEERS
Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuation and Rates
1500 Meadow Lake Parkway, Kansas City 14, Mo.

GEORGE H. KENDALL
Consulting Mechanical Engineer
Methods Studies: Process of Product Redesign Existing Products for Greater Profit
Trouble Shooting Production, Design Cost Problems, Specialist Automatic Machinery Processes, Controls, New Developments, Patent Studies, Investigations, New Products & Process Engineering Studies.
P.O. Box 3 (*Est. 1923*) Tel. Darien 5-1504
Noroton Heights 3 Offices Darien, Connecticut

PANELLIT SERVICE CORP.
Instrumentation Systems
ENGINEERS & CONSTRUCTORS
7401 N. HAMLIN AVE. SKOKIE, ILL.
TEL: ORCHARD 5-2500
Los Angeles, Calif. • Wilmington, Delaware
Toronto, Canada

WALLACE CLARK & CO., INC. — *Est. 1920*
Management Consultants
PLANNING—Engineering Production, Maintenance.
CONTROLS—Production, Costs, Inventories, Operations.
ORGANIZATION—Planning, Evaluation, Compensation, Executive Development—High level, confidential recruiting.
521 Fifth Avenue New York 17, N.Y.

The **Kuljian** *Corporation*
ENGINEERS • CONSTRUCTORS • CONSULTANTS
POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
UTILITY • INDUSTRIAL • CHEMICAL
1200 N. BROAD ST., PHILA. 21, PA.

PROPANE GAS PLANTS
and
Anhydrous Ammonia Plants
PEACOCK CORPORATION
Box 268, Westfield, N. J. Westfield 2-6258

Electrical Testing Laboratories, Inc.
Electrical, mechanical, photometric, radiometric and chemical laboratories, rendering testing, research and associated services, including certification, inspections at factories and field investigations.
2 East End Avenue at 79th St., New York 21

PETER F. LOFTUS CORPORATION
Design and Consulting Engineers
Electrical • Mechanical
Structural • Civil
Thermodynamic • Architectural
FIRST NATIONAL BANK BUILDING
Pittsburgh 22, Pennsylvania

Consult **Z. H. POLACHEK**
REG. PATENT ATTORNEY
1234 Broadway
(at 31St.) New York 1, N. Y.
Phone LO-5-3088

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Design and Supervision of Construction
Mechanical • Electrical • Structural
Sanitary • Chemical Laboratory
Business and Economic Research
New York **READING, PA.** Washington

THE LUMMUS COMPANY
ENGINEERS AND CONSTRUCTORS
395 Madison Avenue, New York, N. Y.
Chicago -- Houston -- London -- Paris
The Hague -- Montreal -- Caracas -- Bombay

SANDERSON & PORTER
DESIGN
CONSTRUCTION
NEW YORK NEW YORK

HARZA ENGINEERING COMPANY
CONSULTING ENGINEERS
E. Montford Fucik Calvin V. Davis
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control Irrigation
River Basin Development
400 West Madison Street Chicago 6

research and development
product engineering and styling
special production machines
model building
write for brochure
MAST DEVELOPMENT CO. INC
2212 E 12th St DAVENPORT, IOWA

Power Plants, Structures
Transmission Systems
Design, Supervision, Inspection
Appraisals, Reports
SARGENT & LUNDY
140 S. Dearborn St., Chicago, Ill.

JACKSON & MORELAND, INC.
Engineers and Consultants
Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications
BOSTON NEW YORK

WELD TESTING
Qualification of Operators—Supervision
Inspection—Research
NATIONAL WELD TESTING BUREAU
Pittsburgh Testing Laboratory, Pittsburgh, Pa.

J. E. SIRRINE COMPANY
Engineers
Design and Supervision of Steam and Hydro-Electric Power Plants. Industrial Plant, Mechanical and Operating Surveys, Appraisals • Plans • Reports
Greenville, South Carolina

M. W. KELLOGG
Piping System Flexibility Analyses
Unique model tester as well as modern digital computer facilities available for low cost, accurate flexibility analyses of the most complex piping systems.
The M. W. Kellogg Company
711 Third Avenue, New York 17, N. Y.

An announcement in this section will acquaint others with your specialized practice

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
208 S. LaSalle Street Chicago 4, Illinois
Hershey Building Muscatine, Iowa

The above consultants are available
to work out solutions
to your engineering and management problems.

(Left to right) Dr. John Bardeen*, Dr. William Shockley* and Dr. Walter H. Brattain, shown at Bell Telephone Laboratories in 1948 with apparatus used in the early investigations which led to the invention of the transistor.

Bell Telephone Laboratories Salutes Three New Nobel Prize Winners

Drs. John Bardeen, Walter H. Brattain and William Shockley are honored for accomplishments at the Laboratories

The 1956 Nobel Prize in Physics has been awarded to the three inventors of the transistor, for "investigations on semiconductors and the discovery of the transistor effect."

They made their revolutionary contribution to electronics while working at Bell Telephone Laboratories in Murray Hill, N. J. Discovery of the transistor was announced in 1948. Bell Laboratories is proud to have been able to provide the environment for this great achievement.

This is the second Nobel Prize awarded to Bell Telephone Laboratories scientists. In 1937 Dr. C. J. Davisson shared a Nobel Prize for his discovery of electron diffraction.

Such achievements reflect honor on all the scientists and engineers who work at Bell Telephone Laboratories. These men, doing research and development in a wide variety of fields, are contributing every day to the improvement of communications in America.

**Dr. Bardeen is now with the University of Illinois, and Dr. Shockley is with the Shockley Semiconductor Laboratory of Beckman Instruments, Inc., Calif.*

Bell Telephone Laboratories
WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

Index to Advertisers

AC Electronics Div., General Motors Corp. 62, 64, 74, 154
*Adsco Industries (Inc.) American District Steam Div. 105
Aerojet-General Corp. Sub. General Tire & Rubber Co. 60, 61, 148
*Aldrich Pump Co. 108
All American Tool & Mfg. Co. 88
Allen-Bradley Co. 137, 138
*American Blower Corp. Div. American-Standard 131
*American Pulverizer Co. 74
ASME Publications 68, 76, 110
Amplex Div., Chrysler Corp. 26
Argonne National Laboratory 120

*Babcock & Wilcox Co.
Atomic Energy Div. 100
Boiler Div. 2nd Cover
Tubular Products Div. 24
*Badger Mfg. Co. 6, 7
Barco Mfg. Co. 79
Battelle Institute 161
Bechtel Corp. 156
Bell Telephone Labs. 167
Bendix Aviation Corp., Pacific Div. 163
Bendix Products Div.—Missiles 156
Bigelow-Liptak Corp. 30
Boeing Airplane Co. 92
Bonney Forge & Tool Works 43
Bulova Watch Co. 146
Burgess-Manning Co. 134
Byers, A. M., Co. 139

Caltech, Jet Propulsion Laboratory 90
Carborundum Co. 165
*Cash, A. W., Co. 31
Chain Belt Co. 73
Chapman Valve Mfg. Co. 98
*Chicago Bridge & Iron Co. 27
Chrysler Corp., Engrg. Div. 152
Cincinnati Gear Co. 72
Clarage Fan Co. 123
Clearprint Paper Co. 97
*Columbia-Geneva Steel Div. 140, 141, 169
*Combustion Engineering (Inc.) 118
Convair Div. General Dynamics Corp. 44, 77
Cramer Posture Chair Co. 136
Crane Co. 119
Crucible Steel Co. of America 29

Delco Radio Div., General Motors Corp. 72
Denison Engineering Co. 113
Diamond Chain Co. (Inc.) 13
*Diamond Power Specialty Corp. 8, 9
Downey Missile Engrg. Div. North American Aviation (Inc.) 112
*Dresser Industries (Inc.) Roots-Connersville Blower Div. 57
du Pont de Nemours, E. I. & Co. 149, 155

Eagle Signal Corp. 51
*Elastic Stop Nut Corp. of America 93
Electric Boat Div. General Dynamics Corp. 161

Farnsworth Electronics Co. 146
Firestone Guided Missile Div. 170
Formica Corp. 109
*Foster Wheeler Corp. 14, 15
*Foxboro Co. 132, 133

Garrett Corp. 50
*Gear Specialties (Inc.) 2
General Electric Co. 16, 161
*Goulds Pumps (Inc.) 75

Hamilton Mfg. Co. 143
Hamilton Standard Div. of United Aircraft Corp. 116
Hankison Corp. 136
Heating & Air-Conditioning Exposition 70
Horspool & Romine Mfg. Co. 86
*Hyatt Bearings Div., General Motors Corp. 20, 21

*Illinois Gear & Machine Co. 121
Imperial Tracing Cloth 134
International Business Machines 142
International Nickel Co. 34
Irving Subway Grating Co. 19

Jenkins Bros. 40
Johns Hopkins University 70

Kennametal (Inc.) 45

*Ladish Co. 17
Leiman Bros. 134
Lenape Hydraulic Pressing & Forging Co. 135
LimiTorque Corp. 115
Linde Air Products Co. Div. Union Carbide & Carbon Corp. 145, 152
Linear (Inc.) 136
*Link-Belt Co. 18
Lockheed Aircraft Corp. 153
Los Alamos Scientific Laboratory 151
Lunkenheimer Co. 3rd Cover

McDonnell & Miller (Inc.) 86
M B Mfg. Co. 28
Manzel Div. of Houdaille Industries (Inc.) 47
Martin Co. 52, 63
Melpar (Inc.) Sub. of Westinghouse Air Brake Co. 48
*Mercoid Corp. 76
Midwest Piping Co. 4, 5
Motorola (Inc.) 150

National Cash Register Co. 160
National Supply Co. 130
New Departure Div., General Motors Corp. 1
New Mexico Institute of Mining & Technology 164
Niagara Blower Co. 135
North American Aviation (Inc.) 96
Los Angeles Div. 66
*Northern Blower Co. 67
Northrop Aircraft (Inc.) 58
Nugent, Wm. W. & Co. 69

*Oilgear Co. 91
Olin Mathieson Chemical Corp. 148

*Pangborn Corp. 65
Pantex Mfg. Corp. 87
Parker White Metal Co. 32
*Pennsylvania Pump & Compressor Co. 88
Pennsylvania State University 148
Philadelphia Gear Works 115
Pittsburgh Lectrodryer Co. 102
*Porter, H. K., Co. W-S Fittings Div. 49
Powell, William, Co. 12
Pratt & Whitney Div. United Aircraft Corp. 82

Radio Corp. of America 145
Ramo-Wooldridge Corp. 144
Raybestos-Manhattan (Inc.) Packing Div. 83
*Raytheon Mfg. Co. 159
Reaction Motors (Inc.) 162
Read Standard Corp. 42
Reliance Electric & Engineering Co. 117
Reliance Gauge Column Co. 54
Remington Rand Univac Div. Sperry Rand Corp. 157
Republic Aviation Corp. 150
Revere Copper & Brass (Inc.) 101
Reznor Mfg. Co. 59
Ric-Wil (Inc.) 111
Rocketdyne Div. North American Aviation (Inc.) 114
Rockford Clutch Div. Borg-Warner Corp. 84
*Roots-Connersville Blower Div. Dresser Industries (Inc.) 57
Ross Heat Exchanger Div. American-Standard 89
Rust-Oleum Corp. 125
Ruthman Machinery Co. 62

Sanborn Co. 81
Sandia Corp. 124
*Smith, S. Morgan, Co. 53
*Southwest Products Co. 135
Stephens-Adamson Mfg. Co. 10, 11
Sturtevant, P. A., Co. 86
Sylvania Electric Products (Inc.) 145
Synchro-Start Products (Inc.) 134

*Taylor Instrument Cos. 25
Temco Aircraft Corp. 147
*Tennessee Coal & Iron Div. 140, 141, 169
*Terry Steam Turbine Co. 122
Texas Instruments (Inc.) 158
Thomas Flexible Coupling Co. 71
Timken Roller Bearing Co. 4th Cover
*Titusville Iron Works Co. Div. of Struthers Wells Corp. 46

*Union Carbide Nuclear Co. Div. Union Carbide & Carbon Corp. 163
*Union Iron Works 107
United States Graphite Co. Div. Wickes Corp. 94, 95, 128, 129
*United States Hoffman Machy. Corp. 127
*United States Steel Corp. 140, 141, 169
*United States Steel Export Co. 140, 141, 169
Universal Drafting Machine Corp. 85
University of Calif., Radiation Lab. 126

*Vogt, Henry, Machine Co. 103

Waldes Kohinoor (Inc.) 33
Walworth Co. 3
Western Gear Corp. 37
*Westinghouse Electric Corp. 80, 104
Wheeler, C. H., Mfg. Co. 106
*Wickes Boiler Co. Div. of Wickes Corp. 22, 23
Wiegand, Edwin L., Co. 78

*Yarnall-Waring Co. 35
Yoder Co. 78

*Zallea Brothers 99

* The asterisk indicates that firm has product catalog in the 1957 Mechanical Catalog.

Your attention is directed to

Keep Informed 41–88
Consulting Service 166
Opportunities 145–164

NOTHING *can equal Stainless Steel*

in its unique combination of properties

No other design material can match Stainless Steel in its unique combination of desirable properties: corrosion resistance, strength, hardness, beauty, cleanability and easy fabrication. If you're looking for a reliable source of supply, remember that United States Steel offers you the widest range of types, finishes and sizes.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS
PIPE · TUBES · WIRE · SPECIAL SECTIONS

UNITED STATES STEEL

For Formability...

Jet engine and pressure vessel makers are using roll-formed rings in large numbers these days. Alloy Manufacturing Company in Pittsburgh is a major supplier of Stainless Steel fabricated parts, and they process this steel on ordinary "carbon steel rated" equipment without difficulty.

For Cleanliness...

Bates Manufacturing Company, Lewiston, Maine, is a famous name in cotton goods. They used to have trouble with dyeing equipment; the iron vats held the old colors and "killed" new colors. With Stainless Steel dye kettles, old colors actually *rinse* out, without costly scrubbing.

For Style...

G & G Woodcraft, Dinette Division, in Detroit, is selling a handsome new dinette table, designed by Gelitis, with a polished Stainless Steel top. The top is backed with plywood, and there is no metallic sound when it is struck. Stainless is a perfect material for contemporary design, and it's so *practical*.

what is grey matter worth?

For the engineer or scientist who has enough to make him different, ***grey matter*** is worth a rewarding life of creative achievement in a working climate where ideas are King...and the benefits measure up to the man and his mind.

For 56 years Firestone has grown on ***grey matter*** – in Research, Development and Production. Now, simply, we need additional ***grey matter*** for such Firestone "firsts" as the "Corporal" surface-to-surface ballistic missile. Here are just a few of the Engineering activities in which Firestone needs more ***grey matter:***

Electronics Systems
Mechanical Systems
Propulsion Components
Flight Simulation
Mechanical Structures and Dynamics
Stress Analysis
Metallurgical Lab

If you're the man with extra ***grey matter*** who wants the chance to really use it, write us today. We'll put you in touch with a Firestone man who has your kind of ***grey matter***, too.

Firestone

GUIDED MISSILE DIVISION

RESEARCH • DEVELOPMENT • MANUFACTURE

"Find your Future at Firestone"– Los Angeles • Monterey

WRITE: SCIENTIFIC STAFF DIRECTOR, LOS ANGELES 54, CALIF.

LQ600 VALVES

• NO LEAKAGE • NO EROSION
• NO WIRE DRAWING
. . . In 100,000 applications and 5 years of tests

Famous LQ600 Bronze Valves, with revolutionary Brinalloy seats and discs, now solve maintenance problems in a new wider range of services!

The lower pressure LQ600-150 made valve history during five years of cost-cutting use in a big variety of installations, ranging from "normal" to "exceptionally severe."

Now the higher pressure LQ600-200 offers all the same proved features — plus a stronger body and bonnet of exclusive Lunkenheimer S-1 Bronze. It has a total temperature rating of 550°F.

It will pay you to specify and install LQ600 in your toughest 150 and 200 lb. services. New Brinalloy seats and discs resist wear and corrosion to an amazing degree — far greater than 500 Brinell Stainless Steel . . . even outwear case hardened Stainless Steel exceeding 1000 Brinell. The flat seats and discs are micro-optically lapped to a perfect fit — and brazed in to stay.

Call your Lunkenheimer distributor or write The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.

BRONZE • IRON • STEEL • PVC

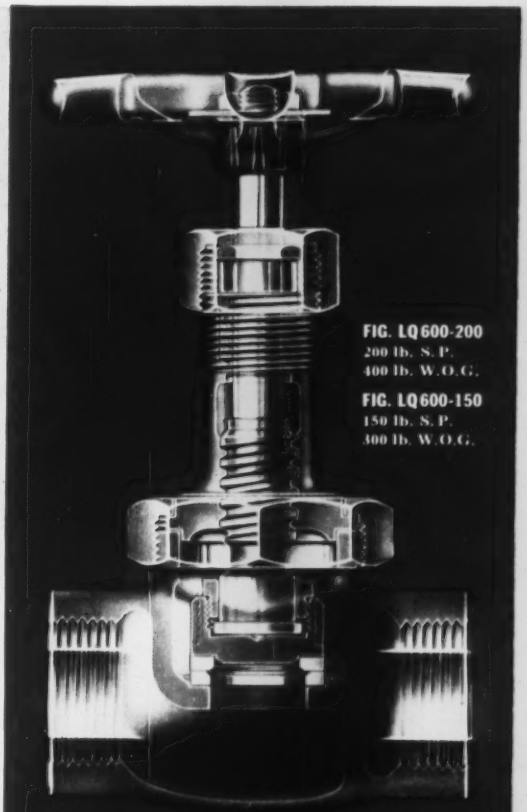


FIG. LQ600-200
200 lb. S.P.
400 lb. W.O.G.

FIG. LQ600-150
150 lb. S.P.
300 lb. W.O.G.

NOW AVAILABLE FOR

200 LB. S.P. 550°F. 400 LB. W.O.G. and 150 LB. S.P. 300 LB. W.O.G.

APPLICATIONS

BRINALLOY* SEATS AND DISCS

*Patented Alloy —TM Reg.

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

L 556-24

New design cuts setup time— TIMKEN® bearings up precision

BECAUSE it has no cams to change, this Warner & Swasey 2AC Single Spindle Chucking Automatic sets up fast like a turret lathe, gives you automatic operation without the usual time-consuming setup procedures.

And among the many design features contributing to the lasting production accuracy of the 2AC is the mounting of the spindle on Timken® tapered roller bearings.

Because of their tapered design, Timken bearings take radial and thrust loads in any combination, hold the spindle in rigid alignment.

Full line contact between Timken bearing rollers and races provides maximum load-carrying capacity. And, because Timken bearings are built to last the life of the machine, maintenance costs go down.

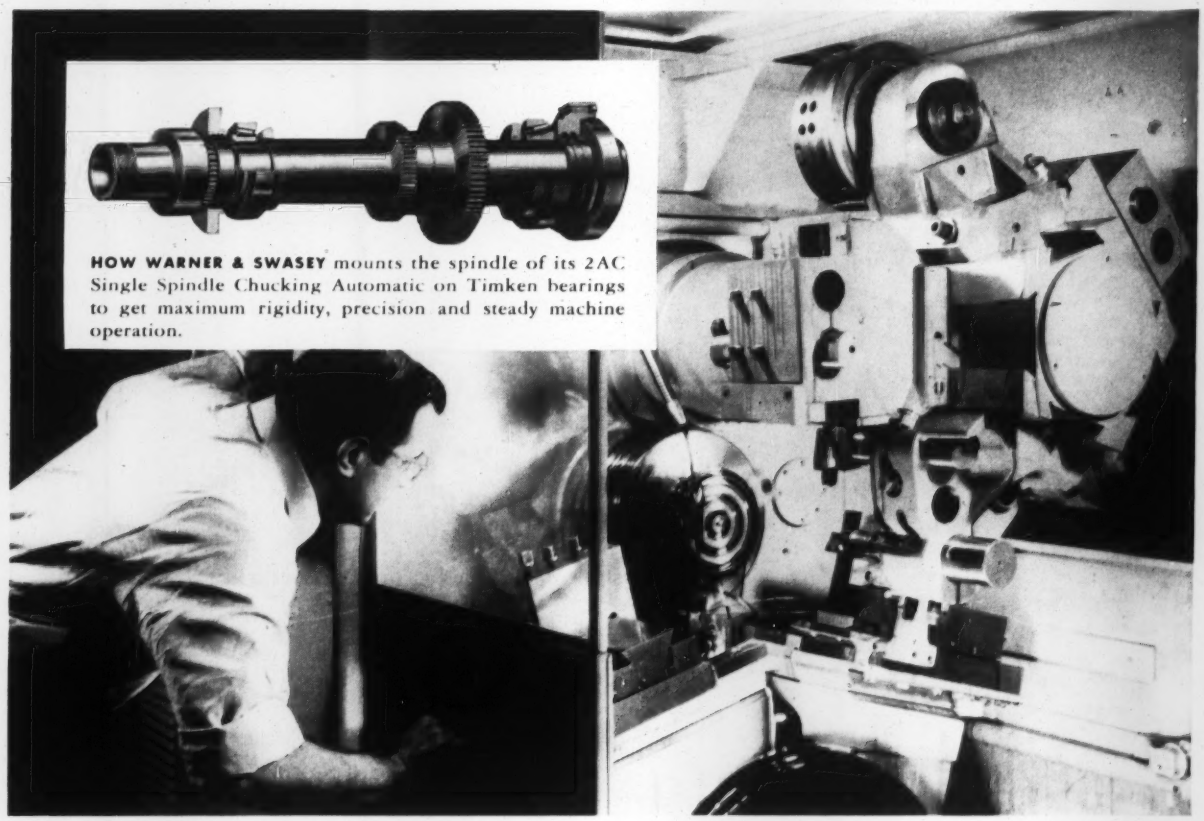
Timken bearings also save power because they practically eliminate friction. They are geometrically designed to give true rolling motion, precision manufactured to live up to their design. And to be sure we get steel good enough for Timken bearings, we make our *own* fine alloy steel. We're America's only bearing manufacturer that does.

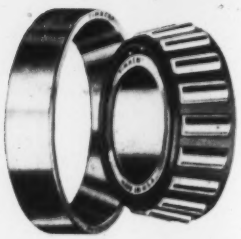
No other bearings give you all the advantages that Timken bearings give you. That's why so many manufacturers of equipment that *must* have dependable bearing performance use them. Whether you buy or build machinery, be sure to specify Timken bearings. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.

HOW WARNER & SWASEY mounts the spindle of its 2AC Single Spindle Chucking Automatic on Timken bearings to get maximum rigidity, precision and steady machine operation.

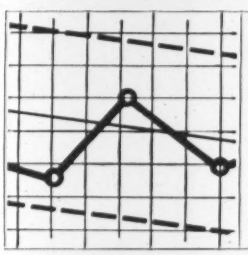




TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS



STATISTICAL QUALITY CONTROL

To insure uniform high quality and closer tolerances, the Timken Company uses statistical quality control. With it, tolerance deviations are plotted graphically. It's one of industry's newest, most scientific methods of improving product uniformity.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◎ AND THRUST ◎ LOADS OR ANY COMBINATION